

DC-6/DC-6T/DC-6Vet

Diagnostic Ultrasound System

Service Manual

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2. Freight policy: The customer is responsible for freight charges when this product is shipped to Mindray for service (this includes customs charges).
3. Return address: Please send the part(s) or equipment to the address offered by Customer Service department

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Safety Precautions

1. Meaning of Signal Words

In this operator's manual, the signal words  **DANGER**,  **WARNING** and **NOTE** are used regarding safety and other important instructions. The signal words and their meanings are defined as follows. Please understand their meaning before reading this manual.

Signal word	Meaning
 DANGER	Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.
 WARNING	Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.
 CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
NOTE	Indicates a potentially hazardous situation that, if not avoided, may result in property damage.

2. Meaning of Safety Symbols

Symbols	Description
	Type-BF applied part The ultrasound transducers connected to this system are Type-BF applied parts.
	"Attention" indicates the points that you should pay attention to. Be sure to read the operator's manual concerning these points before using the system.

3. Safety Precautions

Please observe the following precautions to ensure patient and operator safety when using this system.

⚠ DANGER: Do not use flammable gasses such as anesthetic gas, oxygen or hydrogen, or flammable liquids such as ethanol, near this product, because there is danger of explosion.

⚠ WARNING:

1. Do connect the plug of this equipment to the wall receptacle, and the plug must meet the ratings indicated on the rating nameplate. Using an adapter or multi-functional receptacle may affect the system grounding performance and thus causing the leakage current to exceed safety requirements.
In addition, do connect the video printer to the auxiliary power socket of this system. And use the printing cable provided by this system to connect the printer. Otherwise, it may cause electric shock.
2. Be sure to connect the potential-equalization lead wire before inserting the equipment power plug into the receptacle. Also, be sure to remove the equipment power plug from the receptacle before disconnecting the wire to avoid electric shock.
3. Connect the earth conductor only before turning ON the system. Disconnect the grounding cable only after turning OFF the system. Otherwise, electric shock may result.
4. For the connection of power and grounding, follow the appropriate procedures described in this operation manual. Otherwise, there is risk of electric shock. Do not connect the grounding cable to a gas pipe or water pipe, otherwise functional grounding may not be effective or there may be risk of a gas explosion.
5. Before cleaning the system, be sure to disconnect the power cable from the outlet. If the system is defective, there is risk of electric shock.

6. No waterproof device is applied to this equipment. Do not use this equipment in any place with the possibility of water ingress. There is risk of electric shock if any water is sprayed on or into the equipment. If carelessly spray any water onto the equipment, contact the Mindray sales office, customer service department or representative.
7. Use the transducer carefully. In case that the body contacts the scratched transducer surface, immediately stop using the transducer and contact the Mindray sales office, customer service department or representative. There is risk of electric shock if using the scratched transducer.
8. Be careful not to let the patient contact the live parts of the ultrasound equipment or other devices, such as signal I/O ports. If the ultrasound equipment is defective, there is risk of electric shock.
9. Do not use the transducers other than those specified by Mindray. Otherwise, the equipment and the transducer may be damaged, causing an accident such as a fire in the worst case.
10. Do not subject the transducers to knocks. Use of defective transducers may cause an electric shock.
11. Do not open the shell or front panel. If you open the shell when the system is powered on, there may be a short circuit or electric shock.
12. Do not use this system with using equipment at the same time such as an electrosurgical unit, high-frequency therapy equipment, or a defibrillator, etc. otherwise it may result in electric shock to the patient.
13. Use only the ECG leads provided with the ECG module, otherwise it may result in electric shock.
14. If this system needs to be moved, please hold the handle. If other parts of the system are held, it may cause damage due to the abnormal force. Do not push the system from the left/right side; otherwise it may be toppled over.

15. Accessory equipment connected to the analogue and digital interfaces must be complied with the relevant IEC standards (e.g., IEC 60950 Safety of information technology Equipment Standard and IEC 60601-1 Medical Equipment standard). Furthermore all configurations should comply with the standard IEC60601-1-1. Any person, who connects additional equipment to the signal input or output ports and configures a medical system, is responsible for ensuring that the system complies with the requirements of IEC60601-1-1. If you have any problem, consult the technical services department of your local representative.

16. Prolonged and repeated use of keyboards can result in hand or arm nerve disorders for some individuals. Observe the local safety or health regulations concerning the keyboard use.



CAUTION: 1. Precautions concerning clinical examination techniques:

- (1) This system must be used only by qualified professionals.
- (2) This operation manual does not describe clinical examination techniques. Selection of the proper clinical examination technique must be based on specialized training and clinical experience.

2. Malfunctions due to radiowaves:

- (1) Use of radiowave-emitting devices in the proximity of this medical electronic system may interfere with its operation. Do not bring or use devices that generate radio waves, such as cellular telephones, transceivers, and radio controlled toys, in the room where the system is installed.
- (2) If a person brings a device that generates radio waves near the system, ask him/her to immediately turn OFF the device.

3. Precautions concerning installation and movement of the system:

- (1) Ensure to install the equipment horizontally and lock up the casters securely. Otherwise, it may move to cause injury.
- (2) Do not move the equipment from its sides; otherwise it may be toppled over and may injure people.
- (3) When you move the equipment on a slope, it shall be moved slowly by two people; otherwise it may happen to slide and severely injure people.
- (4) Do not sit on the equipment, because it may move and make people lose balance and fall.

- (5) Do not place any object on the monitor, because it may fall and injure people.
 - (6) Fasten the peripheral devices before moving the equipment. Otherwise, the peripheral devices may fall and injure people.
 - (7) When moving the equipment on steps, you shall prevent it from being toppled.
- 4. Do not vibrate the equipment excessively (when moving the equipment); otherwise the mechanical parts (such as casters) may be damaged. If the equipment is often moved on a bumpy floor, contact the Mindray sales office, customer service department or representative.
- 5. Do not connect this system to outlets with the same circuit breakers and fuses that control the current of devices such as life-support systems. If this system malfunctions and generates an overcurrent, or when there is an instantaneous current at power ON, the circuit breakers and fuses of the building's supply circuit may be tripped.
- 6. Always keep the machine dry. Avoid transporting this machine quickly from the cold place to the warm place; otherwise condensation or water drops may be formed, causing short circuit.
- 7. If the circuit breaker is tripped, it indicates that the machine or the peripheral devices have problems. In these cases, you cannot repair by yourself but should contact the Mindray sales office, customer service department or representative.
- 8. There is no risk of high-temperature burns during routine ultrasound examinations, even if, due to environment temperature and exam modes, the surface temperature of the transducer exceeds the body temperature of the patient. To prevent high-temperature burns, do not apply the transducer to the same region on the patient for a long time. Apply the transducer only for as long as required time for diagnosis.
- 9. This device and its accessories are not disinfected and sterilized when they are out of the factory, so the user shall disinfect and sterilize transducers or biopsy brackets as per the manuals prior to use of transducers or biopsy brackets. After the sterilization or disinfection of accessories, chemicals must be washed out or gases must be discharged thoroughly from the accessories. Remaining residual chemicals or gases will not only result in damage to the accessories but also can be harmful to human bodies.



10. Before examining a new patient, press the  key to delete the patient information and data recorded in the image memory for the previous patient. Otherwise, the new data may be confused with the data of the previous patient.
11. Do not connect/disconnect the system and its accessories (such as printers or DVD recorder) without turning OFF the power; otherwise it may cause damage of the equipment or electric shock.
12. Do not turn OFF the power supply of the system during printing, saving, or invoking; otherwise these processes may not be completed normally or files may be lost.
13. During operation, if the system is improperly powered off, it may result in data damage of the hard disk or system failure.

NOTE:

1. Do not use the machine in the vicinity of strong electromagnetic field (such as the transformer), which may affect the performance of the machine.
2. Do not use the machine in the vicinity of high-frequency radiation source, which may affect the performance of the machine or even lead to failure.
3. To avoid damaging the machine, do not use the machine in following environment:
 - (1) Locations exposed to direct sunlight;
 - (2) Locations subject to sudden changes in temperature;
 - (3) Dusty locations;
 - (4) Locations subject to vibration;
 - (5) Locations near heat generators;
 - (6) Locations with high humidity.
4. Turn ON the system only after the power has been OFF for more than 20 seconds. If the system is turned ON immediately after being turned OFF, the system may malfunction.
5. Turn OFF the auxiliary power switch or stop transmission through the 『Freeze』 key before connecting or disconnecting a transducer. If a transducer is connected or disconnected with an image displayed, the system and/or the transducer may malfunction.

6. After using the transducer, remove the ultrasound gel on it and place the transducer on the transducer holder. Otherwise, water in the gel may enter the acoustic lens, thus adversely affecting the performance and safety of the transducer.
7. You can record the registration data (including the hospital data and patient data). To ensure the security of the data, be sure to back up the data on external storage media. Data stored in the equipment may be lost due to improper operation or an accident.
8. Do not apply external force to the control panel (e.g. leaning against it). Otherwise it may damage the system.
9. If the system is used in a small room, the room temperature may rise. Therefore, proper ventilation shall be provided.
10. When disposing the system or any part of it, contact your Mindray representative. Do not dispose of this system without consulting Mindray. Mindray would bear no responsibility for damages resulting from disposal of this system without consulting Mindray.
11. Degradation of electrical and mechanical safety characteristics (such as generation of a leakage current or deformation/abrasion of mechanical parts) and of image sensitivity and resolution may occur after a period of time. To ensure normal operation of the system, it is recommended to sign a maintenance and service agreement to prevent accidents.
12. Output power outlet in the system is used to supply power for the recommended peripheral devices. Do not connect other devices to the outlet, otherwise the rated output power may be exceeded and failure may result. Maximum output power of the power outlet for peripheral devices is 350VA.

4. Warning Labels

Various warning labels are attached to this system in order to call the user's attention to potential hazards.

The symbol  on the warning labels indicates safety precautions. The warning labels use the same signal words as those used in the operation manual.

Detailed information about the warning labels is given in the operation manual. Read operation manual carefully before using the system.

The name, pattern and the meaning of each warning label are described as follows:

No.	Label	Meaning
<1>		(a) CAUTION: Do not sit on the system. (b) Before using the system, be sure to carefully read the relevant content of this operation manual. (c) DANGER: The system must not be used around flammable gasses.
<2>		(a) CAUTION: Do not place the system on a sloped surface. Otherwise the system may slide unexpectedly, resulting in person injury or the system malfunction. The system should be moved over a sloped surface by two persons to ensure safety. (b) CAUTION: The system shells must not be opened, because the high voltage inside may cause electric shock.
<3>		Beware of excessive stress exerted to the system.

1

General Description

1.1 System Characteristics

The DC-6/DC-6T/DC-6Vet Diagnostic Ultrasound System is a color Doppler system with features of all-digital architecture and whole-body application, which is designed based on clinical needs. The system supports a wide range of transducers, and its imaging modes include B Mode, M mode, Pulsed Wave Doppler (PW), Continuous Wave Doppler (CW), Color, and Power, Smart3D, iScape and Free Xros M. It supports single-frame files such as formats of DICOM, BMP and JPEG, and Cine files such as CIN and AVI; the silicone keyboard and flexible trackball are adopted for the system; the high-performance ICs are used to realize the front-end transmission and reception and back-end software functions; the system is suitable for a wide variety of hospitals and clinics.

1.2 Applicable Scope

The DC-6/DC-6T Diagnostic Ultrasound System is applicable for adults, pregnant women, pediatric patients and neonates, and it is intended for use in abdominal, cardiac, small parts (breast, testes, thyroid, etc.), peripheral vascular, fetal, transrectal, transvaginal, pediatric, neonatal cephalic, musculoskeletal (general and superficial), and intraoperative (liver, gallbladder, pancreas) exams.

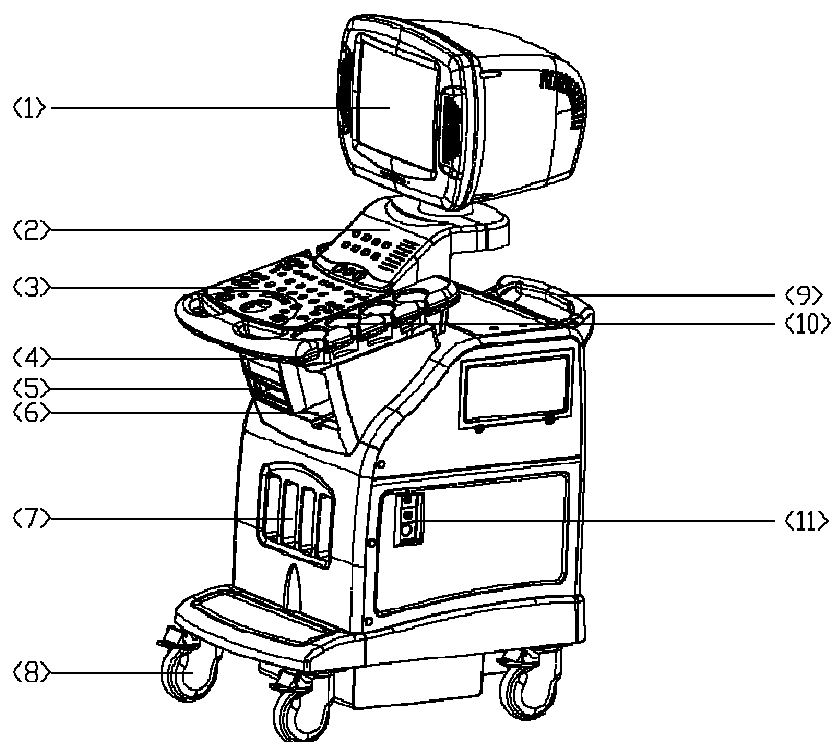
The DC-6Vet Diagnostic Ultrasound System is intended for use in abdominal, cardiac, obstetric, small parts, peripheral vascular, transrectal, musculoskeletal (general and superficial), and intraoperative exams for animals, such as dog, cat, equine, bovine and ovine, etc.

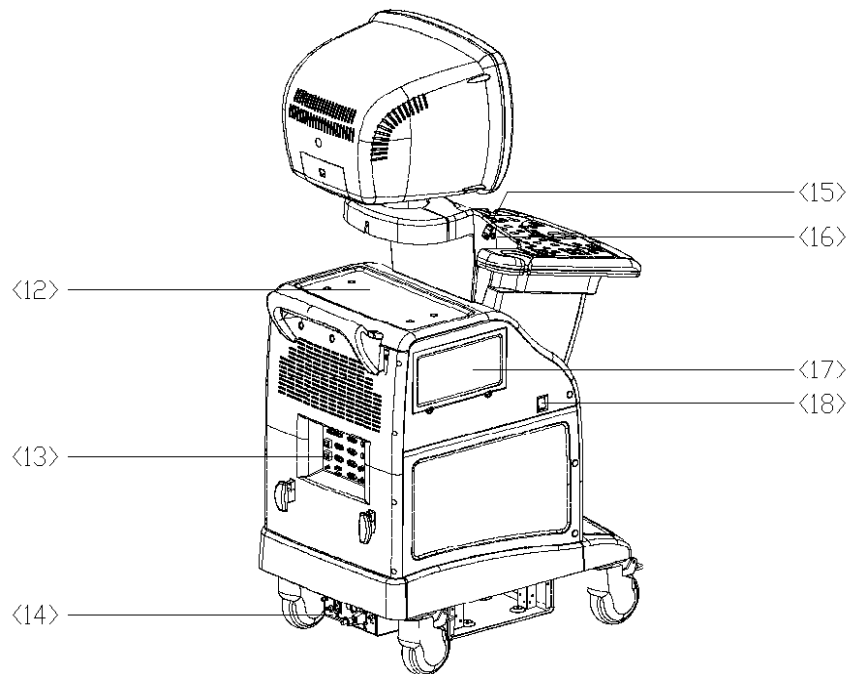
2

System Overview

2.1 System Appearance

2.1.1 Complete System with CRT Monitor

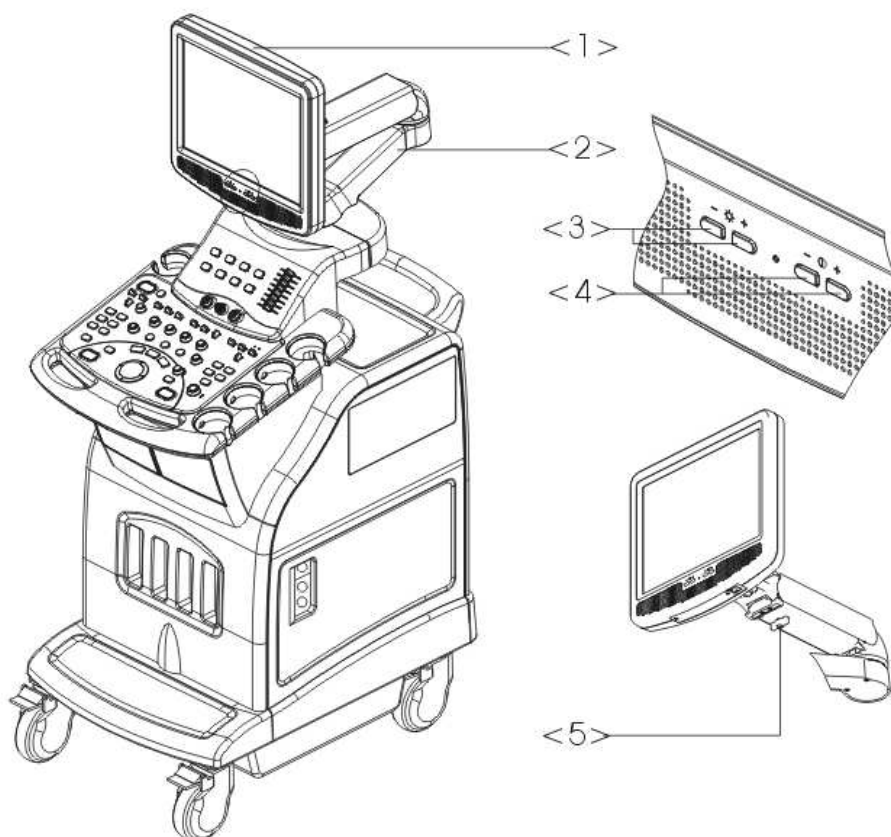




No	Name	Function
<1>	Monitor	Displays the images and parameters during scanning
<2>	Minor panel	Human-machine interface, operation control
<3>	Main panel	Human-machine interface, operation control
<4>	Keyboard	Human-machine interface, operation control
<5>	DVD-R/W	Rewritable CD drive
<6>	Space for placing video printer	Used for placing B/W video printer
<7>	Transducer socket	Interface connecting transducers and the main unit There are 3 active sockets and one dummy socket
<8>	Casters	Used for fixing or moving the system
<9>	Handle	Used for pushing the system
<10>	Transducer holder	Used for placing transducers temporarily
<11>	ECG panel	Used for connecting the ECG cable and footswitch, etc.
<12>	Table for placing color printer	Used for placing color video printer
<13>	I/O panel	Interface panel for input and output signals
<14>	Power panel	Electrical interface panel
<15>	USB interface	Used for USB devices
<16>	MIC interface	Used for connecting a microphone
<17>	Space for placing VCR	Used for placing VCR

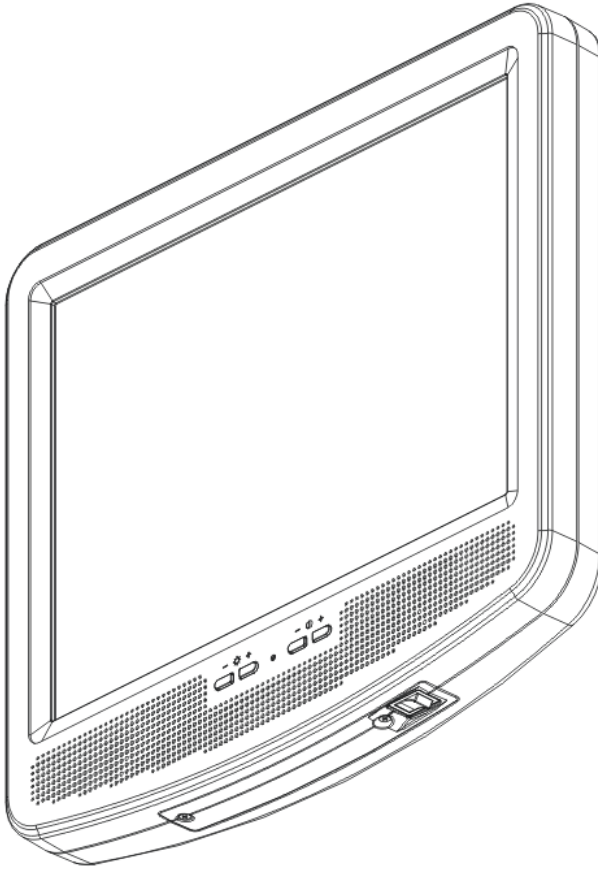
<18>	Power switch	Used for turning on/off the power supply
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2.1.2 Complete System with LCD Monitor



No	Name	Function
<1>	Monitor	Displays the images and parameters during scanning
<2>	Monitor support arm	Supports and adjusts height and position of LCD monitor
<3>	Brightness buttons	Adjust brightness of LCD monitor
<4>	Contrast buttons	Adjust contrast of LCD monitor
<5>	Locking lever	Locks the monitor in the lowest status

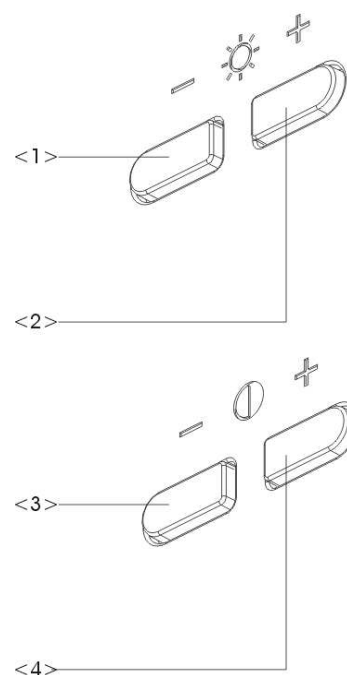
2.2 LCD Monitor



2.2.1 Brightness and contrast buttons

In the figure at the right side, <1> and <2> are brightness-adjusting buttons, above which is a sun symbol. A “-” symbol above the <1> button indicates the button is used to decrease brightness. A “+” symbol above the <2> button indicates the button is used to increase brightness.

<3> and <4> are contrast-adjusting buttons, above which is a lune symbol. A “-” symbol above the <3> button indicates the button is used to decrease contrast. A “+” symbol above the <4> button indicates the button is used to increase contrast.

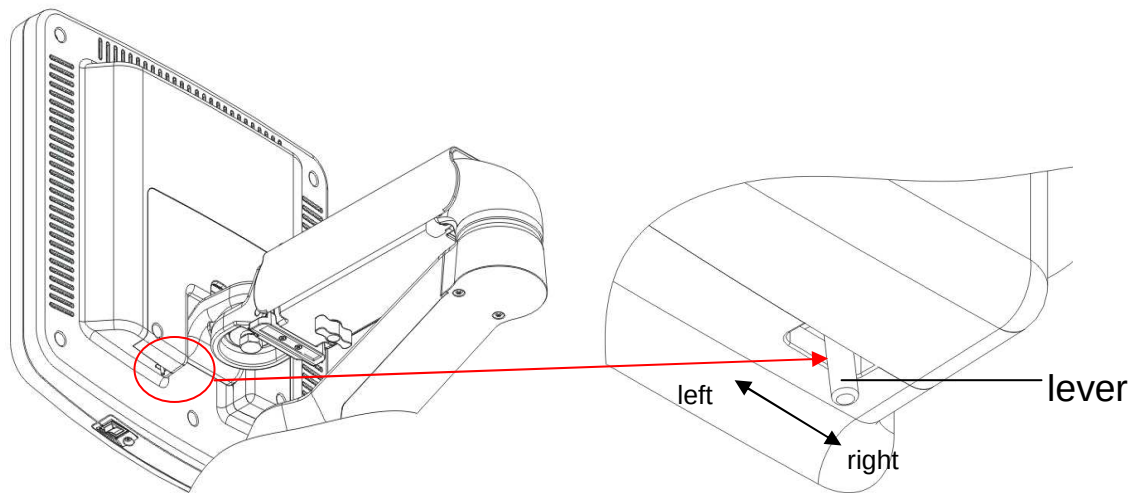


Press both <2> and <3> buttons at the same time and hold for more than 3s, the default brightness and contrast settings will be recovered.

Press both <1> and <4> buttons and hold for more than 3s to pop up the service menu of the monitor, select “zoom select” to choose the image size to display; the default value is “user”.

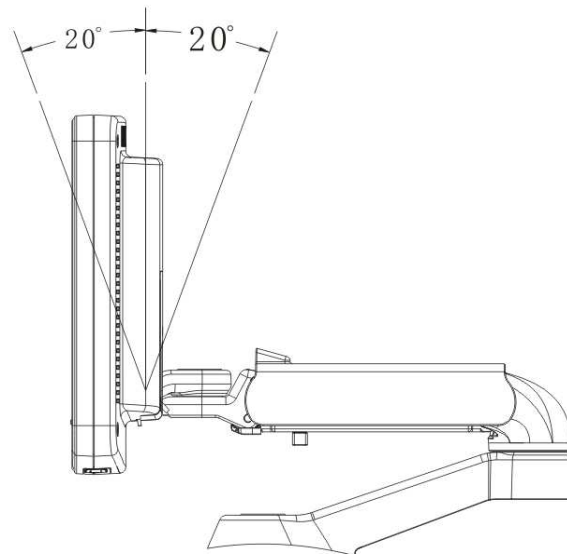
NOTE: <1> and <2> are used to move the cursor up and down; <3> is used as “cancel” and <4> is used as “OK”.

2.2.2 Up/down adjusting lever

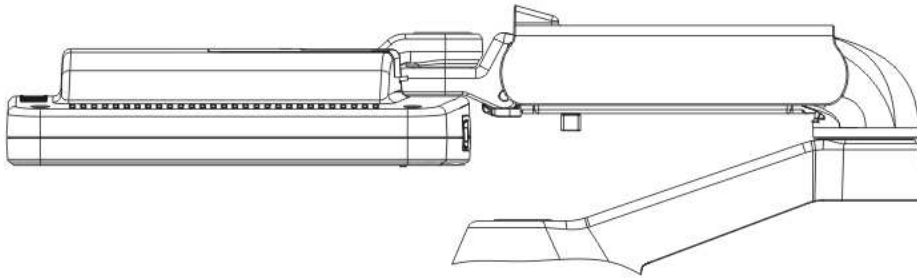


As shown in the figure above, the lever is located at the lower left of the monitor back. Only when the lever is placed in the rightmost position can it be used for up/down adjustment of the monitor. (Note: if there is no lever for another type of monitor, you can adjust it directly.)

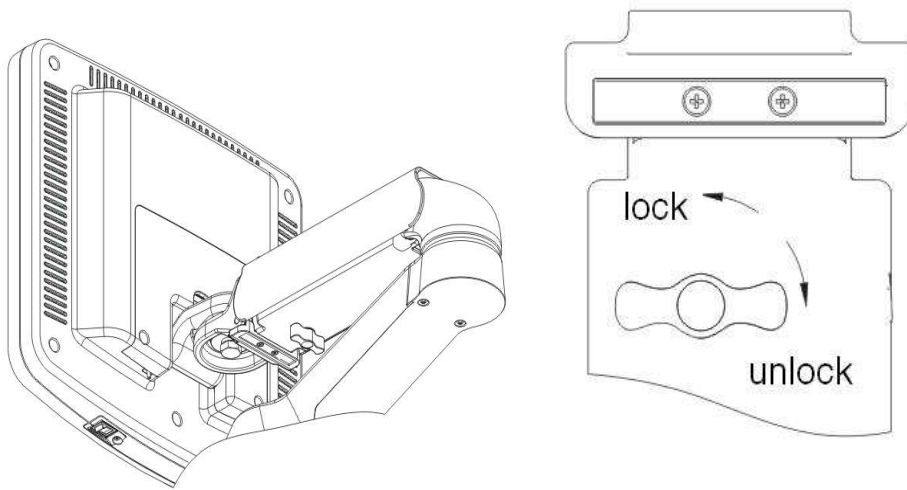
The monitor can be tilted 20 degrees downward or upward. See the figure below.



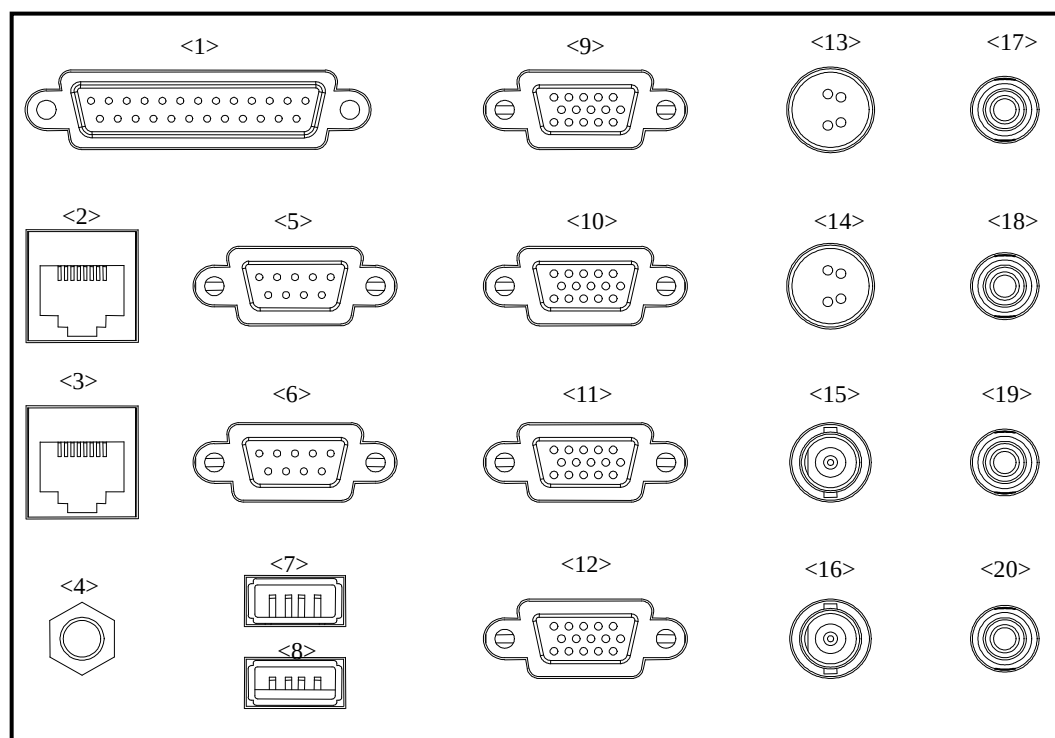
When the system is packed for transportation or moved to another place, push the lever to the left side and push down the monitor so that the monitor is placed in the horizontal position. See the figure below.



2.2.3 Lever of upper support arm

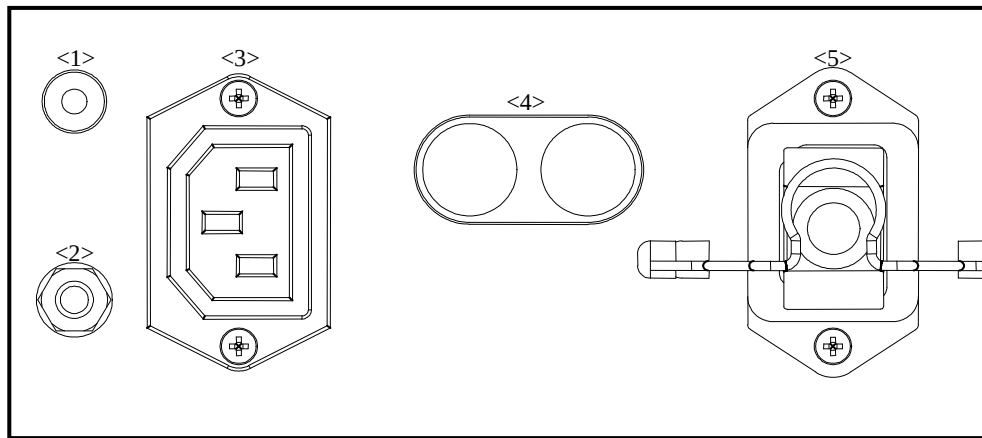


2.3 I/O Panel



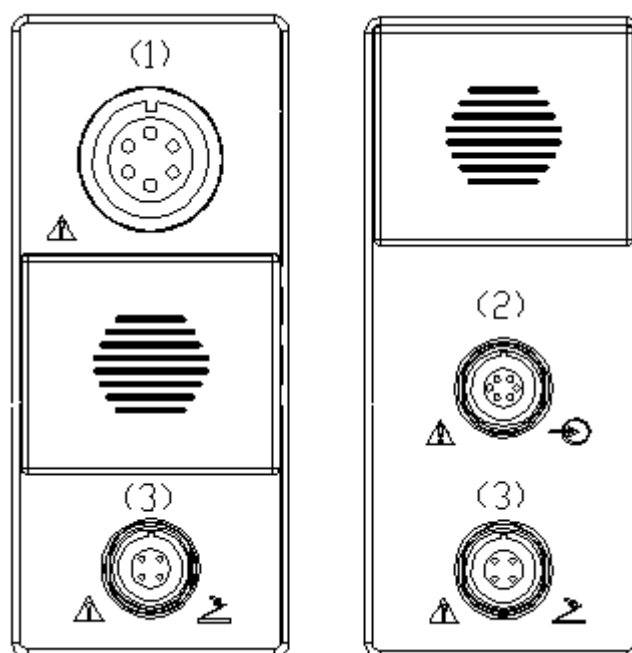
No	Symbol	Function
<1>		Used for system recovery
<2>, <3>		Ethernet interface (<2> is reserved for future use; <3> can be used now.)
<4>		System reset
<5>		Serial port
<6>		Control port for color video printer
<7>, <8>		USB port (<8> is used for USB devices, while <7> is for expansion.)
<9>,<10>		Used for VGA I/O
<11>,<12>		Used for RGB component video I/O
<13>,<14>		Used for separate video I/O
<15>,<16>		Used for composite video I/O
<17>,<18> <19>,<20>		Used for stereo audio I/O

2.4 Power Panel



No	Name	Function
<1>	Ground terminal	Used for grounding connection
<2>	Equipotential terminal	Used for equipotential connection
<3>	Power outlet	Power supply for optional peripheral devices
<4>	Circuit breaker	Used for cutting off power supply of the system
<5>	Power inlet	AC power inlet

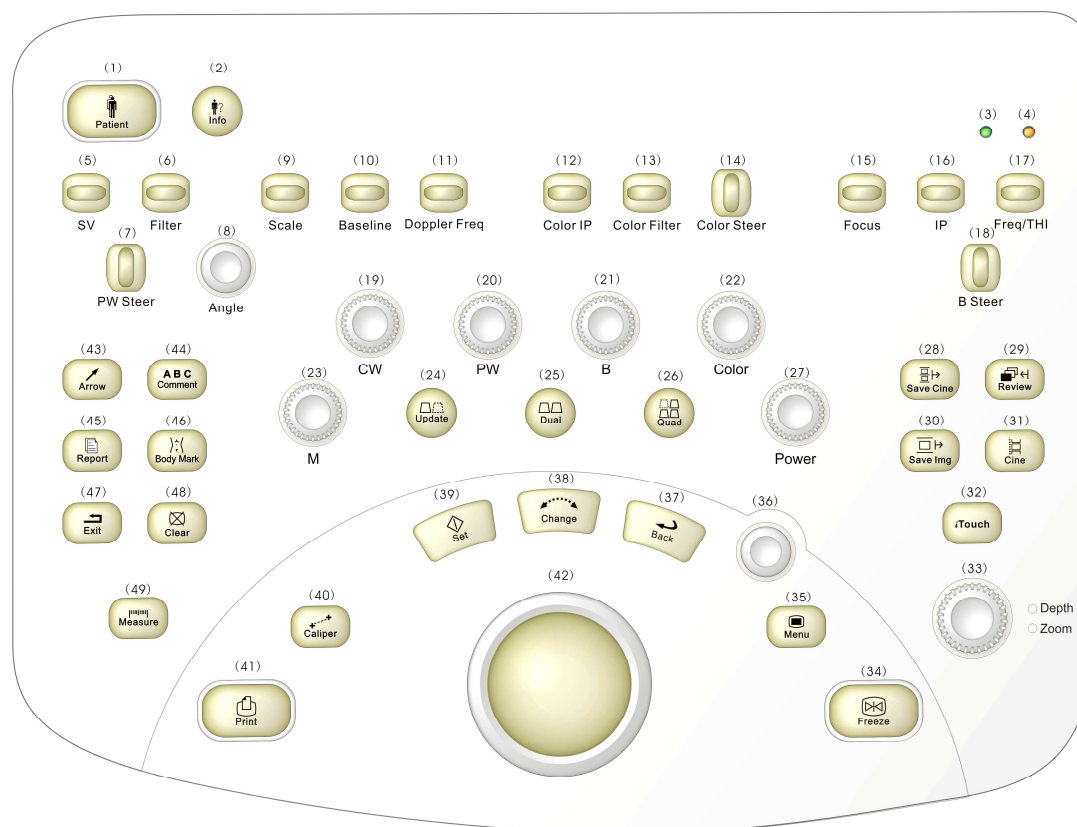
2.5 ECG Panel



No	Name	Function
<1>	ECG lead signal input interface	Used for connecting ECG leads and acquiring ECG signals
<2>	External ECG signal input port	Used for connecting the signal output port of ECG monitor
<3>	Footswitch interface	Used for connecting the footswitch

2.6 Control Panel

2.6.1 Main panel

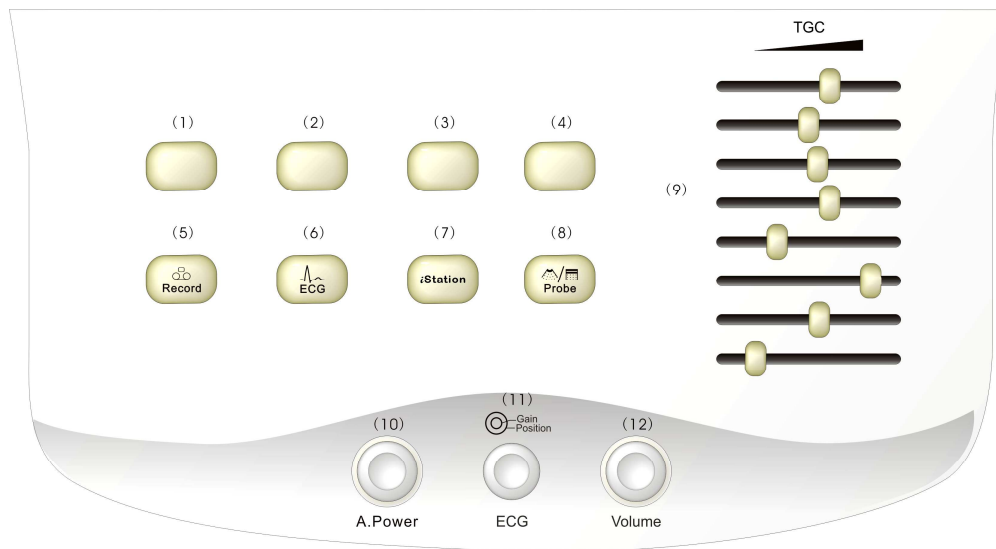


No	English Name	Function
<1>	Patient	Press to start an exam of a new patient.
<2>	Info	Press to enter the patient information input screen.
<3>	/	Power indicator
<4>	/	Hard disk indicator
<5>	SV	Toggle to adjust the size of sample volume.
<6>	Filter	Toggle to adjust wall filter frequency in the PW mode.
<7>	PW Steer	Toggle to adjust SV steering angle of a linear transducer in the PW mode.
<8>	Angle	Toggle to adjust SV corrected angle in the PW mode.
<9>	Scale	Toggle to adjust pulse repetition frequency in the Color/Power/PW mode.
<10>	Baseline	Toggle to adjust baseline position in the PW/Color mode.
<11>	Doppler Freq	Toggle to adjust transmit frequency in the Color/Power/PW mode.
<12>	Color IP	Toggle to select IP parameter combinations in the Color/Power mode.
<13>	Color Filter	Toggle to select wall filter in the Color/Power mode.

<14>	Color Steer	Toggle to adjust ROI steering angle of a linear transducer in the Color/Power mode.
<15>	Focus	Toggle to adjust focus position for B images.
<16>	IP	Toggle to select IP for B images.
<17>	Freq/THI	Toggle to adjust the current transducer frequency and harmonic frequency.
<18>	B Steer	Toggle to adjust steering scan of a linear transducer or trapezoid imaging.
<19>	CW	Press to enter the CW mode; rotate to adjust gain of a CW image.
<20>	PW	Press to enter the PW mode; rotate to adjust gain of a PW image.
<21>	B	Press to enter the B mode; rotate to adjust gain.
<22>	Color	Press to enter the Color Doppler mode; rotate to adjust gain.
<23>	M	Press to enter the M mode; rotate to adjust gain of an M image.
<24>	Update	Press to switch between image windows in M/B mode, PW/B or CW/B mode., Press to start or end image capture in the 3D mode.
<25>	Dual	Enters dual-split screen display, or changes the live image window in Dual.
<26>	Quad	Enters the quad-split screen display, or changes the live image window in the Quad mode.
<27>	Power	Press to enter the Power Doppler mode; rotate to adjust gain.
<28>	Save Cine	Quickly saves cine files to the default region of the internal hard disk in the preset image format.
<29>	Review	Reviews the image files of the current patient or the last patient.
<30>	Save Img	Quickly saves image files to the default region of the internal hard disk in the preset image format.
<31>	Cine	Enters the cine review status.
<32>	iTouch	Press to optimize images.
<33>	Depth/Zoom	When the Depth indicator lights on, the knob is used for adjusting image depth by turning it; when the knob is pressed down and the Zoom indicator lights on, the knob is used for adjusting magnification factor by turning it.
<34>	Freeze	Freezes or unfreezes an image.
<35>	Menu	Invokes or closes the menu corresponding to the current status.
<36>		Multifunction knob: it functions differently depending upon different statuses. Refer to the relevant sections for specific functions.
<37>	Back	Returns to the previous operation.
<38>	Change	Changes the active point of the caliper during measurement; or opens the comment library in the comment status.

<39>	Set	Confirms an operation, equivalent to the left-button of the mouse.
<40>	Caliper	Starts general measurement function.
<41>	Print	Prints the screen image (video print control).
<42>	Trackball	Adjusts the cursor's position on the screen.
<43>	Arrow	Adds comment arrows, and the arrow orientation is adjusted through the multifunction knob.
<44>	Comment	Press to start the comment function and the system enters the comment status.
<45>	Report	Enters the current patient report.
<46>	Body Mark	Enters the body mark status.
<47>	Exit	Exits the current status.
<48>	Clear	Clears all comments, measurement calipers, and the selected body marks on an image.
<49>	Measure	Starts application measurement functions.

2.6.2 Minor panel



No	English Name	Function
<1>	/	Reserved for future use, can be defined
<2>	/	Reserved for future use, can be defined
<3>	/	Reserved for future use, can be defined
<4>	/	Reserved for future use, can be defined
<5>	Record	Used for data recording, can be defined
<6>	ECG	Entering or exiting the ECG menu
<7>	iStation	Entering the patient files management
<8>	Probe	Switching between effective transducers connected and its exam mode.
<9>	TGC	Adjusting time gain compensation
<10>	A.Power	Adjusting Acoustic Output
<11>	ECG	Adjusting ECG signal position and ECG gain
<12>	Volume	Adjusting Doppler sound volume

2.6.3 Keyboard



■ Ejection of the keyboard

Push the edge of the keyboard inward slightly, and then the keyboard automatically ejects outward. At this time the light under the main control panel is bright automatically to lighten the keyboard.

■ Retraction of the keyboard

Push the keyboard inward, and when a click sound is heard, the keyboard is retracted.

Functions of the keys

No	Key	Function
<1>	Enter	Receiving the input data; or moving the cursor to the head of next row of the text or the input field.
<2>	Esc	Same as that of the 『Exit』 key
<3>	Tab	Jumping to the next operation
<4>	Space	Inserting a space
<5>	Caps Lock	Switching between upper and lower case letters
<6>	Num Lock	Switching between numeric and other characters
<7>	Shift	Press the 『Shift』 key and another key simultaneously, and then upper and lower case letters or upper and lower characters can be switched; Shift +  + Set;
<8>	Ctrl	Combined shortcut, Ctrl +  + Set;
<9>	Alt	Combined key
<10>	Pause/Break	/
<11>	Home	Moving the cursor to the head of the row, or the leftmost side of an edit unit.
<12>	End	Moving the cursor to the tail of the row, or the rightmost side of an edit unit.
<13>	PgUp	Turning pages upward or leftward
<14>	PgDn	Turning pages downward or rightward
<15>	Arrow	Moving the cursor position
<16>	Ins	Switching between insertion and overwrite
<17>	Del	Deleting characters after the cursor
<18>	Back Space	Deleting characters before the cursor
<19>	PrtSc	/
<20>	Win Logo	/
<21>	Application	/

NOTE: "/" symbols represent the keys are undefined.

Functions of the keys F1 to F12

No	Key	Function
<1>	F1	/
<2>	F2	Quickly starting the patient information screen (identical to the 『Info』 key)
<3>	F3	Quickly starting the diagnosis report screen (identical to the 『Report』 key)
<4>	F4	Quickly starting the comment status (identical to the 『Comment』 key)
<5>	F5	/
<6>	F6	/
<7>	F7	/
<8>	F8	/
<9>	F9	Switching to the video replay menu
<10>	F10	Quickly starting preset function
<11>	F11	Turning on/off the display of biopsy guide line
<12>	F12	/

NOTE: for the keys undefined, the user can define functions for them as per needs and habit.

Refer to the “Preset” chapter for details.

2.7 Symbols

This system uses the symbols listed in the following table, and their meanings are explained as well. Refer to “Safety Precautions” for safety symbols.

Symbol	Meaning
	Type-BF device
	Refer to relevant content in the Operation Manual, to avoid safety accidents
	Dangerous voltage
	AC (alternate current)
	Functional earth
	Equipotentiality
	Protective earth
	Breaker ON/OFF
	Power ON/OFF
	Footswitch
	Transducer socket
	Network port
	Parallel port
	Serial port
	S-VIDEO signal interface VIDEO signal interface
	VGA signal RGB signal
	External signal input
	Remote control port
	USB

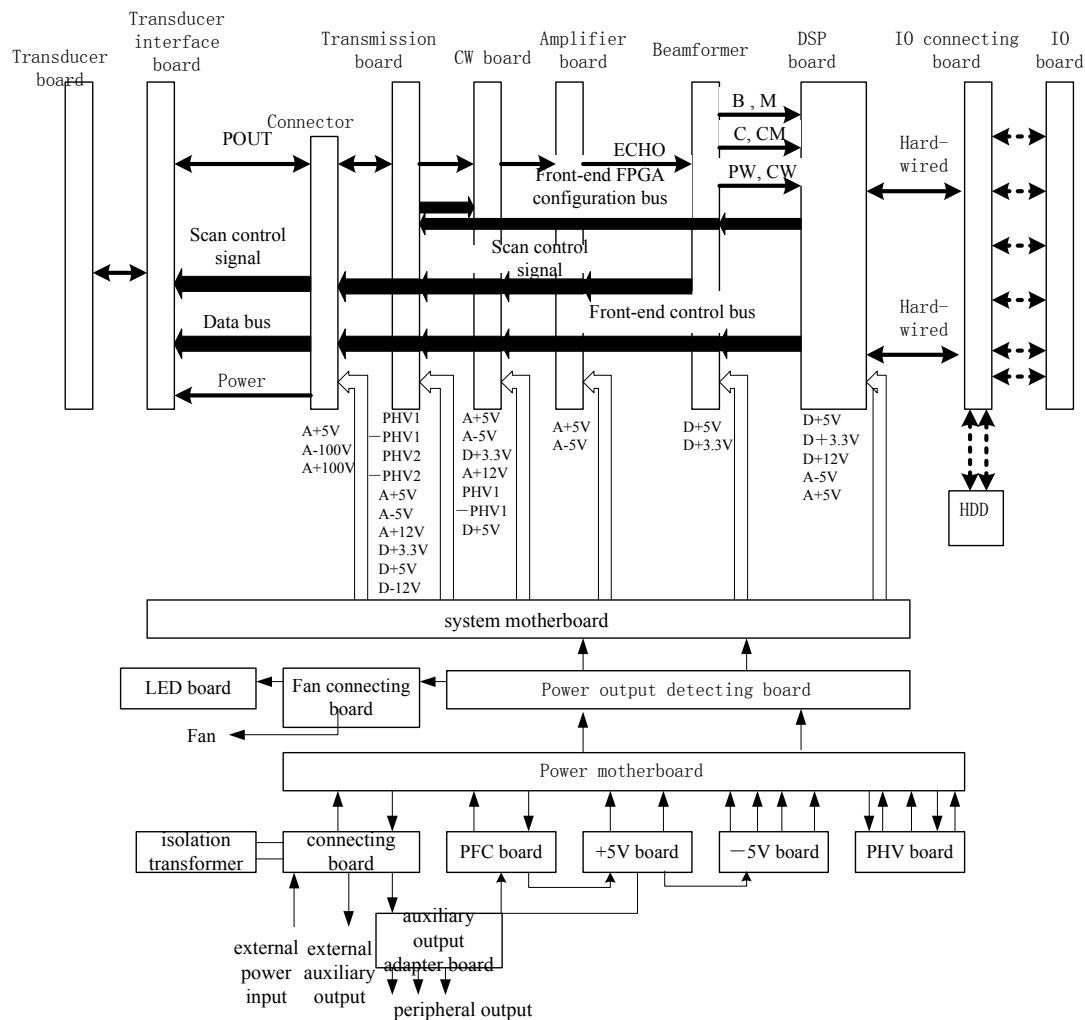
	System reset
	Audio signal
	Microphone input jack
	Product serial number
	Manufacture date
	Manufacturer

3

Principle Description

3.1 Electric Principle of the System

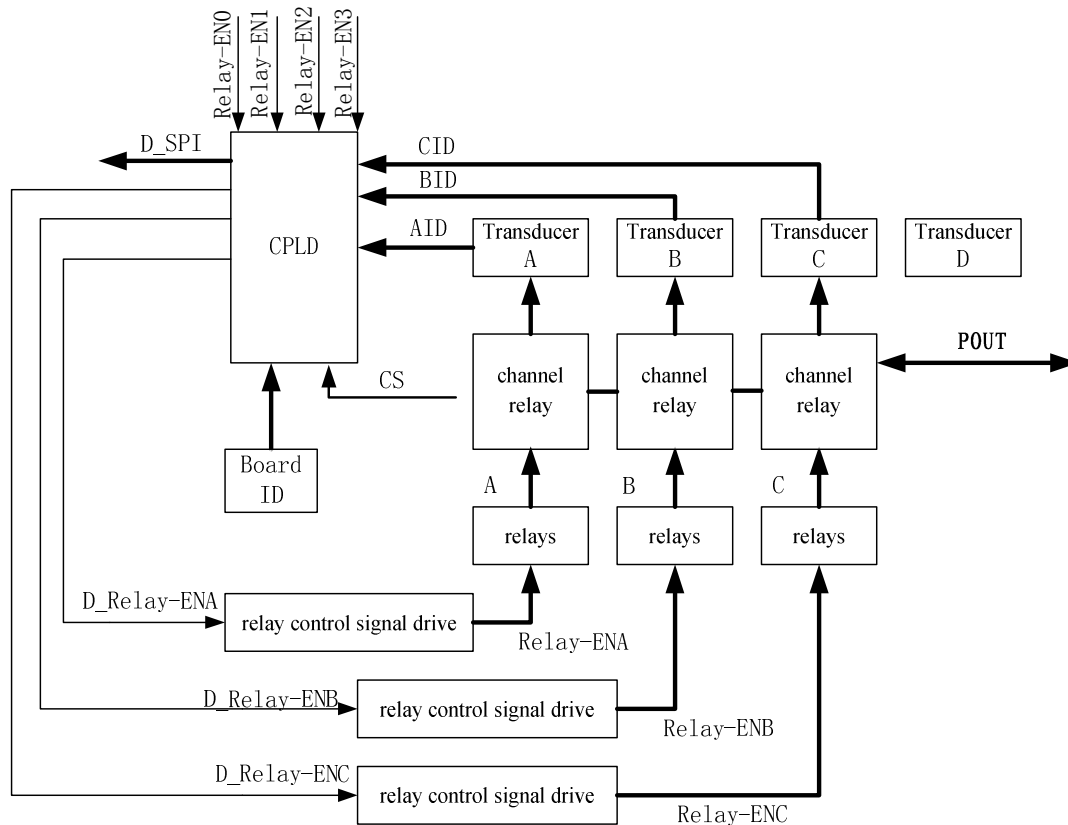
The system consists of transducer module, transmission module, reception module, CW module, beamformer module, B/M-mode signal processing module, color flow signal processing module, Doppler signal processing module, DSC module, CPU system, ECG module, and input/output module, etc.



3.2 Principle of Boards

3.2.1 Transducer Board

The block diagram of the transducer board is shown as follows:



The transducer board is designed for switching between the transducers and recognition of the transducer IDs. The transducer switching signal controls the relays to switch between the transducers, and the ID reading circuit is independent of the transducer switching circuit and can read out the IDs of the transducers.

For A, B, C, and D transducers, the channel, double-pole double-throw relays are respectively adopted to control the status of the transducer. Now take relay drive of the transducer A as an example to describe the principle of the transducer switching. After the transducer select control signal D_Relay-ENA is driven by 245, the four-channel signal D_Relay-ENA is obtained. The four-channel signals are respectively driven by four relays to generate the eight-channel signals A. The A signals respectively control channel relays, so that the element of the transducer A can be selected.

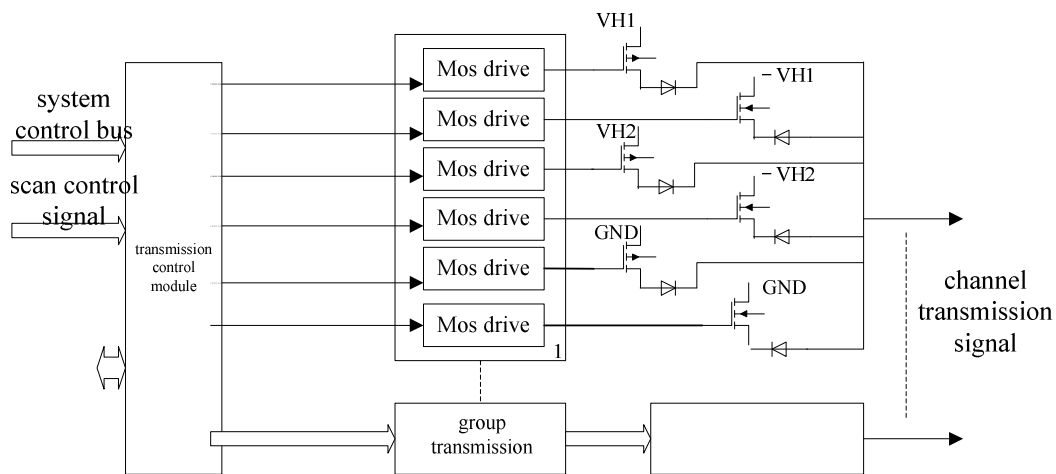
The transducer ID codes are selected by the signal CS and read into CPLD. After the system reads out a transducer's ID code, the system software will set the D_Relay-ENX (X

represents A, B or C) signal to select the corresponding transducer. Since the system may read multiple transducer ID codes simultaneously, the system software will select the corresponding transducer based on the current exam.

When transducers are disconnected or connected, the interrupt signal will be automatically generated to notify the system software, so that the system software can obtain the current status of transducer connection and provide the prompt message accordingly.

3.2.2 Transmission board

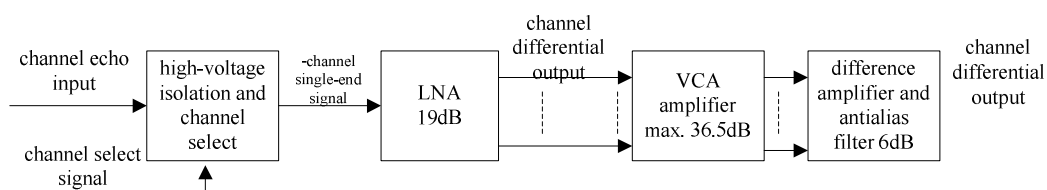
The block diagram of the transmission board is shown as follows:



The transmission board is designed for generation of high-voltage pulse and transmission sequence. The transmission circuit consists of two parts: transmission sequence and transmission drive. The transmission sequence circuit generates low-voltage transmission pulse, which passes the transmission drive circuit and is converted to high-voltage pulse. The transmission board is provided with four programmable transmission voltages by the power supply, so that the board can generate different transmission waveforms depending on the needs of the system.

3.2.3 Amplifier board

The block diagram of the amplifier board is shown as follows:

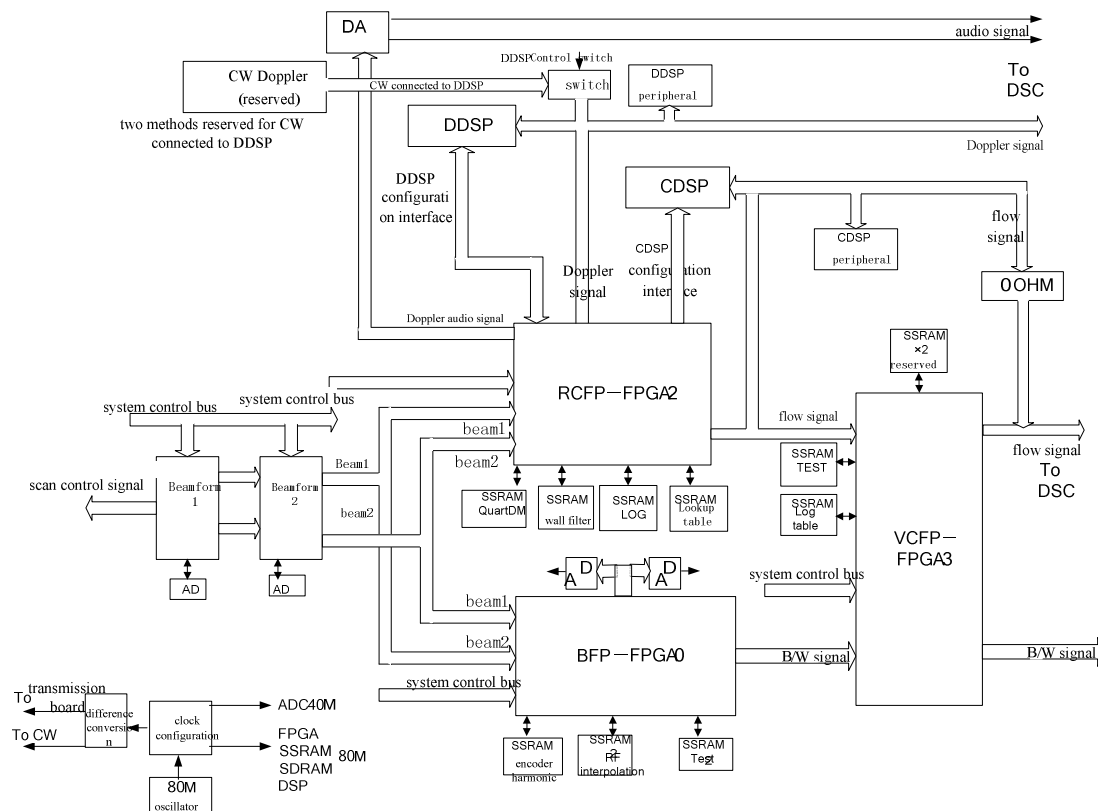


The amplifier board is designed for voltage-controlled gain amplification of small signal echo.

The amplifier board consists of high-voltage isolation circuit, channel select circuit, primary voltage-controlled gain amplification circuit and secondary fixed gain amplification circuit. The control signal of the channel select logic is derived from the beamformer board, and this signal controls the on-off of the reception channel. The primary gain amplification circuit consists of AD8332 and the peripheral circuits. The AD8332 is a dual-channel voltage-controlled gain amplifier, and the gain voltage is derived from DA conversion from the beamformer board and ranges between 0.04V and 1V. The secondary fixed gain amplification circuit consists of AD8132 and the peripheral circuits.

3.2.4 Beamformer board

The block diagram of the beamformer board is shown as follows:



The beamformer board consists of beamformer module, signal processing FPGA module, and signal processing DSP module. The beamformer board is designed for AD sampling, beamforming, radio frequency signal processing, Doppler signal processing, flow signal processing, video signal processing, and generation of scan control signal, etc.

The channel difference analog signal, transmitted from the system motherboard, passes the low-pass filter to avoid aliasing of subsequent AD sampling. The cut-off frequency is 15 MHz.

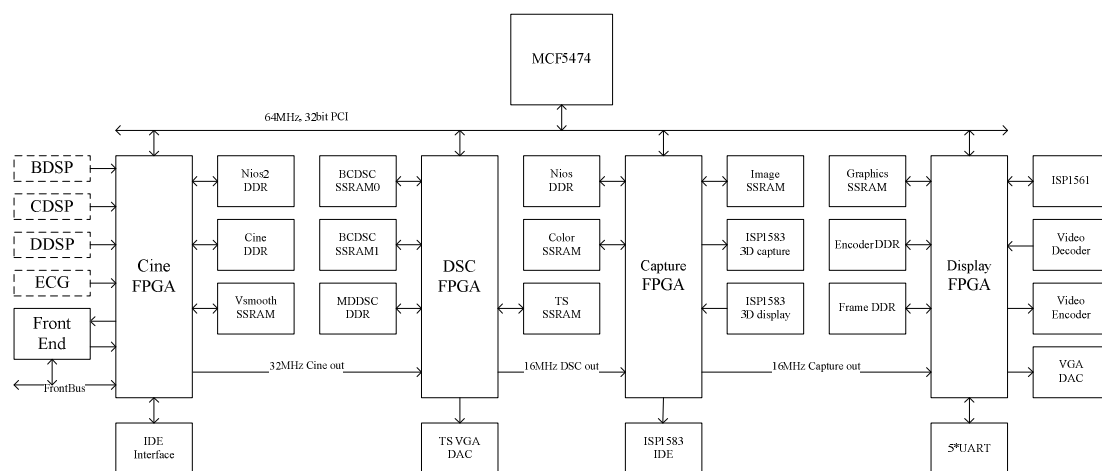
After the signal is filtered and passes 8 pieces of high-speed AD for sampling, the sampled data is sent to FPGA U46 and U65 for beamforming.

The data, after beamforming, is sent to FPGA U4 for B/W signal processing.

At the same time the data is sent to FPGA U59 for color flow signal processing and partial Doppler signal processing. Subsequently part of data is sent to FPGAU83 for remaining color flow signal processing, and the other part of the data is sent to DSP U78 for remaining Doppler signal processing. Then the B/W signal, color flow signal, Doppler signal pass the system motherboard and are sent to the DSP board for the subsequent processing.

3.2.5 DSP board

The DSP board consists of Cine module (Cine), digital scan conversion module (DSC), back-end display module (Display), and data capture module (Capture) and CPU system. Its block diagram is shown as follows:



The Cine, DSC, 3D data capture and back-end display modules are designed for post processing, and the FPGA is adopted for these functions.

The MCF5474 is used as the system CPU, to control the modules and whole system.

The functions of the modules are described as follows:

3.2.5.1 Cine module

- Pre-processing of echo data
- Cineloop storage and review in each mode
- DDR internal memory used for Cineloop storage

The Cine and DSC modules both have 4 parallel data channels for 2-D image, M image, Doppler image and ECG waveform.

3.2.5.2 DSC module

The DSC module is designed for conversion from echo data format to VGA data format.

3.2.5.3 Capture module

The up USB interface is used for transferring original image data to the PC platform.

The down USB interface is used for storage of 3D data calculated by the PC in the RAM.

The USB interface HDD can be realized.

3.2.5.4 Display module

- Processing of graphic and image integration and provision of control interface for main CPU to graphic memory
- The graphic memory is directly accessed by CPU.
- Interface control of video input and output

3.2.5.5 CPU system

- The CPU system is the control core of the ultrasound system, consisting of hardware system and software system. The hardware provides support for functions of the system software, and the software realizes the control of hardware modules. The functions of the CPU system include: image display and measurements, and human-machine interaction.
- Communicating with other MCU or DSP, and configuring, initializing, and monitoring each hardware module;
- Initialization configuration for system FPGA and DSP;
- System control: parameter control for FPGA; management for system controllers; on-line upgrading of each MCU.

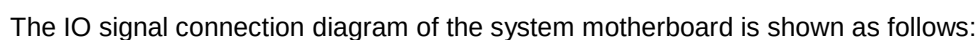
3.2.5.6 Connectors of the DSP board

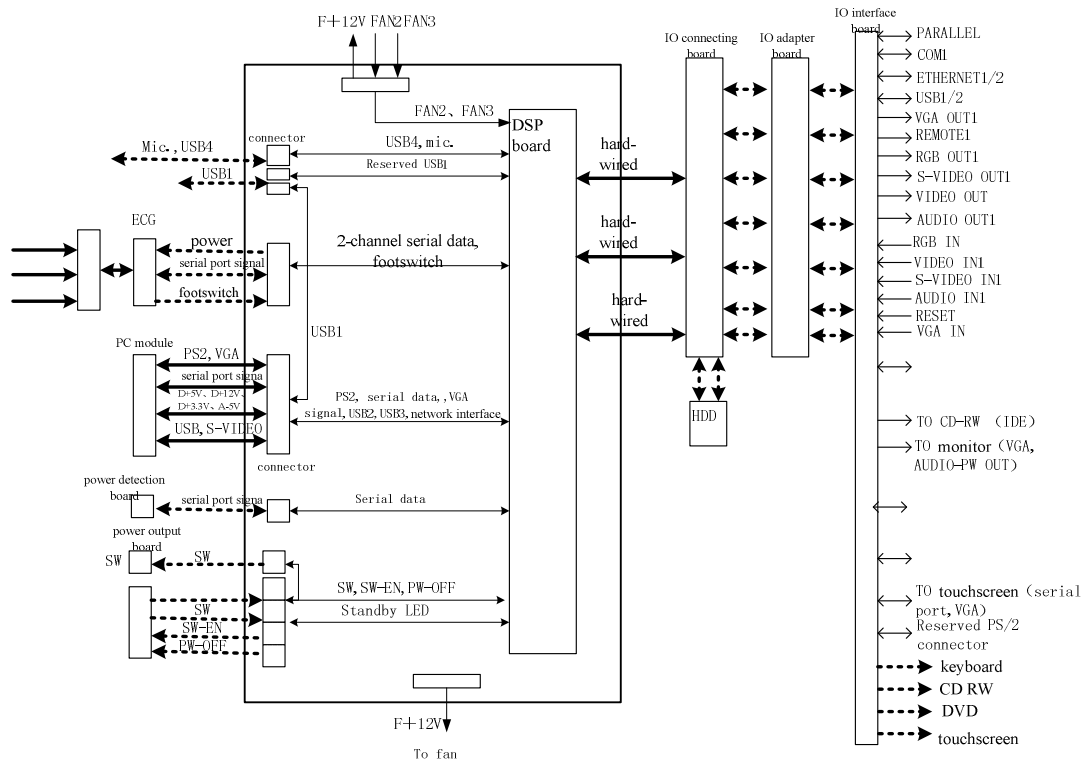
Connector	Description	Status	Remarks
J1	USB IDE HDD interface	Not supported	
J2	Reserved FPGA serial port	Not welded	
J4	Reserved 1561 USB Host port	Not supported	
J6	CPU BDM and JTAG select jumper	No jumper for BDM	
J7	Small HDD socket	Not supported	Either HDD socket or CF socket is welded
J10	JTAG link of PLD	Supported	For JTAG configuration of CPLD and FPGA
J11	JTAG link of CPU and PLD	Not supported	
J14	USB Device interface of CPU	Not supported	
J15	BDM socket interface of CPU	Supported	For CPU system debugging and program downloading
J166	CF card socket	Not supported	
JP1-4	Used for connecting CPU's JTAG link and PLD's JTAG link	Not supported	

3.2.5.7 Functions of LED indicators

Connector	Description	Connector	Description
D1	3.3V power indicator	D27	FPGA configuration indicator

The system motherboard, serving as platform of the hardware system, provides power channels and signal channels for modules.



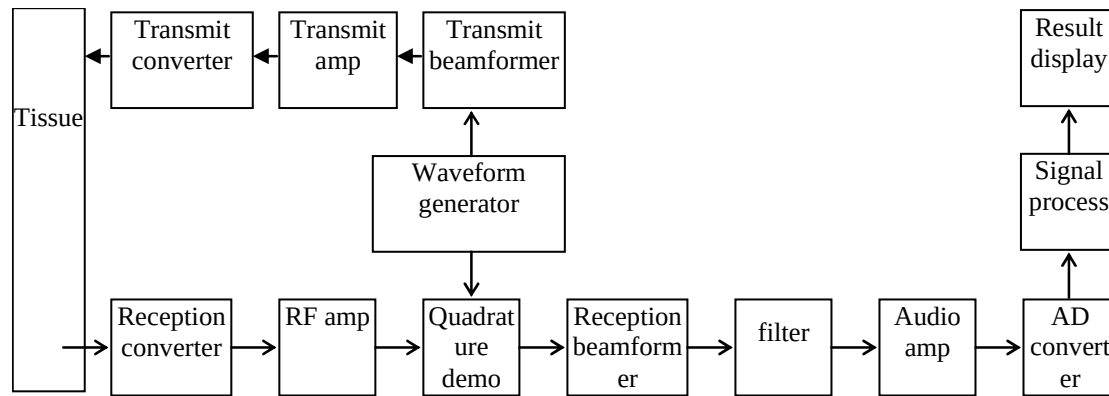


I/O interface definition of the system motherboard:

Category	Interface	Socket number	Use
Interfaces with boards	Hard-wired	5	Connecting transmission board, amplifier board, beamformer board, DSP board, and the board reserved
Transducer connecting board	Hard-wired	1	Transducer signal power signal
ECG module	Soft-wired	1	2 serial ports footswitch Powered by power supply
PC module	Hard-wired	1	1 serial port 3 USB ports S-Video signal Status signal and PC power signal Powered by power supply
USB, microphone	Soft-wired	3	3 USB (one reserved), 1 microphone interface
Footswitch signal	Soft-wired	1	To ECG board
Power control signal	Hard-wired	1	1 serial port, for power control SW, SW-EN soft switch signal, PW-OFF
Power signal	Hard-wired	4	For each channel of power

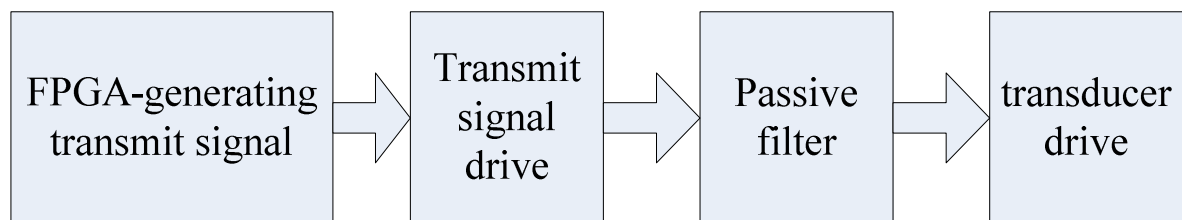
3.2.7 CW board

The CW board diagram is shown below, which consists of four portions: transmission, reception, power and control.



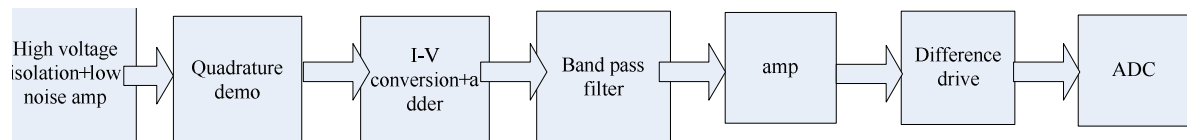
3.2.7.1 Transmission

The transmission signal flow graph is shown as follows:



3.2.7.2 Reception

The reception signal flow graph is shown as follows:



The high voltage isolation circuit is used to protect the reception circuit. Although a relay is placed in the front-end of the reception circuit to isolate from the transducer, if fault occurs for the relay control, the high voltage may be applied to the front-end of the reception circuit. Therefore the high voltage isolation is necessary.

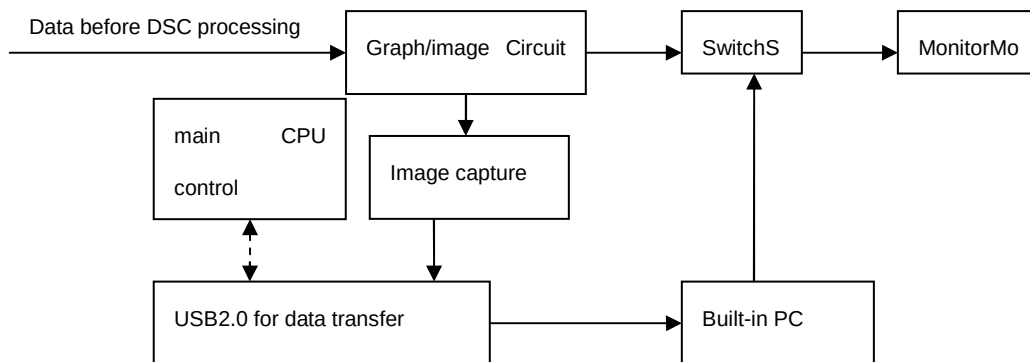
The band pass filter is used to filter extremely low frequency component and sum frequency component in the signal demodulated. It consists of two-level active high-pass filter and four-level active low-pass filter.

3.2.8 Built-in PC module

3.2.8.1 System function

The built-in PC module is used for background processing of 3D and iScape data. The image data is transferred from ultrasound system to PC system via a USB2.0 interface, for the

purpose of analysis, such as 3D imaging. In the figure below, the broken line stands for control flow, while the real lines stand for data streams. The main CPU control communicates with the built-in PC via a serial port. The built-in PC initiates USB2.0 main control of the PC system and USB2.0 slave of the ultrasound system. The data is transferred via USB2.0, and the main CPU system determines that the results are to be displayed whether by the ultrasound system or by the built-in PC.



3.2.8.2 PC carry board

The industrial control PC has advantages in the aspects of reliability, signal interface methods, power supply categories, and power consumption, so it is used as the built-in PC. The built-in PC module consists of PC carry board, industrial control board, memory stick, HDD and fan. The PC carry board is introduced as follows:

The data transfer between the PC carry board and the digital processing board is completed via 2-channel USB2.0 interface;

The PC carry board communicates with the digital processing board 5474 via a serial port;

The S-VIDEO interface is used for maintaining mode display;

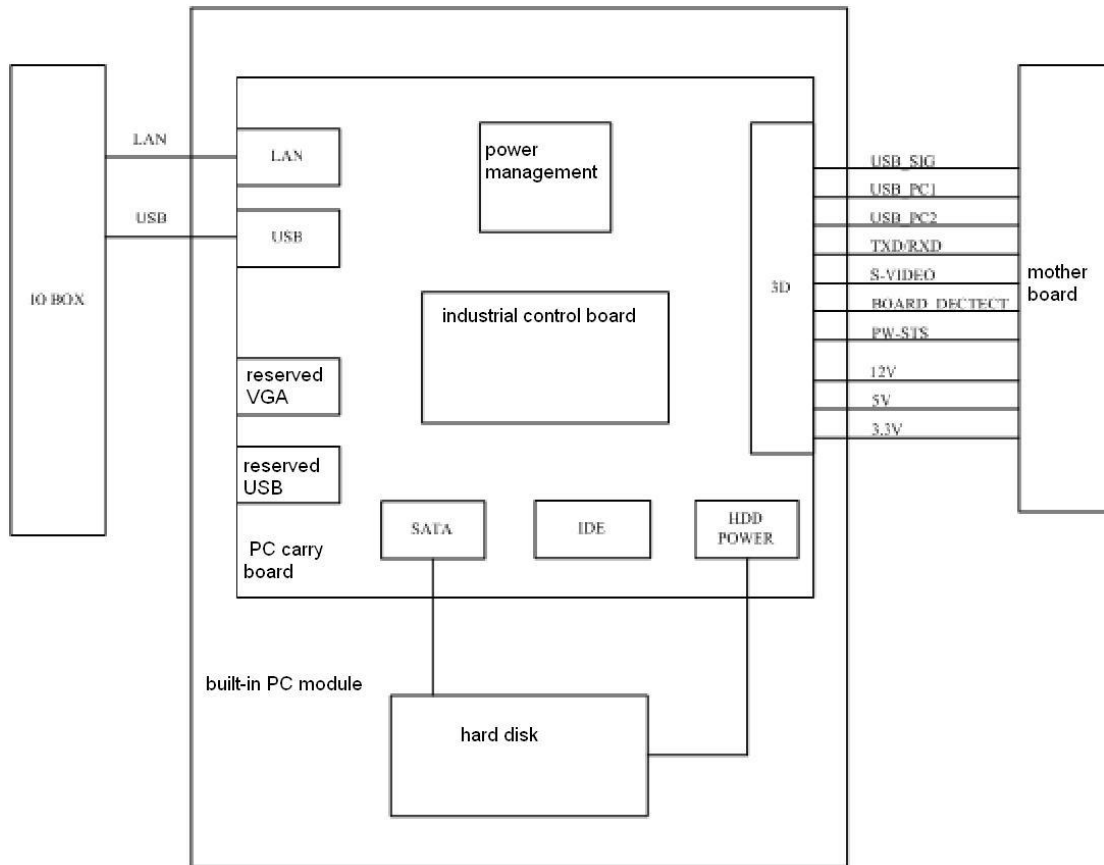
The USB and kilomega Ethernet interface is used for connecting the IO-BOX;

HDD supporting SATA interface is used to store 3D system data;

CPLD is used to manage the system power system;

The PC carry board obtains power of 12V, 5V or 3.3V from the mother board;

The PC carry board interfaces are shown as follows:



3.2.8.3 Interface definition

The ZPACK110 socket is used for connecting the PC carry board and mother board, and signals are defined as follows:

Model: 110Pin PC platform									
PA	SIG.DES	PB	SIG.DES	PC	SIG.DES	PD	SIG.DES	PE	SIG.DES
PA.1	GND	PB.1	DM-SIG	PC.1	DP-SIG	PD.1	GND	PE.1	VBUS-SIG
PA.2	GND	PB.2	DM-PC2	PC.2	DP-PC2	PD.2	GND	PE.2	VBUS-PC2
PA.3	VBUS-PC1	PB.3	DM-PC1	PC.3	DP-PC1	PD.3	GND	PE.3	GND
PA.4	PC-YIN	PB.4	PC-CIN	PC.4	GND	PD.4	GND	PE.4	GND
PA.5	PW-ST5	PB.5	BOARD-DETECT	PC.5	NC	PD.5	NC	PE.5	NC
PA.6	GND	PB.6	GND	PC.6	GND	PD.6	GND	PE.6	GND
PA.7	RXD-PC	PB.7	TXD-PC	PC.7	PS-DATA	PD.7	PS-CLK	PE.7	/
PA.8	GND	PB.8	GND	PC.8	GND	PD.8	GND	PE.8	GND
PA.9	GND	PB.9	GND	PC.9	GND	PD.9	GND	PE.9	GND
PA.10	D+5	PB.10	D+5	PC.10	D+5	PD.10	D+5	PE.10	D+5
PA.11	D+5	PB.11	D+5	PC.11	D+5	PD.11	D+5	PE.11	D+5
PA.12	D+5	PB.12	D+5	PC.12	D+5	PD.12	D+5	PE.12	D+5
PA.13	GND	PB.13	GND	PC.13	GND	PD.13	GND	PE.13	GND
PA.14	GND	PB.14	GND	PC.14	GND	PD.14	GND	PE.14	GND
PA.15	D+3.3	PB.15	D+3.3	PC.15	D+3.3	PD.15	D+3.3	PE.15	D+3.3
PA.16	D+3.3	PB.16	D+3.3	PC.16	D+3.3	PD.16	D+3.3	PE.16	D+3.3
PA.17	GND	PB.17	GND	PC.17	GND	PD.17	GND	PE.17	GND
PA.18	A-5	PB.18	A-5	PC.18	A-5	PD.18	A-5	PE.18	A-5
PA.19	GND	PB.19	GND	PC.19	GND	PD.19	GND	PE.19	GND
PA.20	GND	PB.20	GND	PC.20	GND	PD.20	GND	PE.20	GND
PA.21	D+12	PB.21	D+12	PC.21	D+12	PD.21	D+12	PE.21	D+12
PA.22	D+12	PB.22	D+12	PC.22	D+12	PD.22	D+12	PE.22	D+12

Interfaces between the PC carry board and IOBOX: 1 USB port, 1 network port.

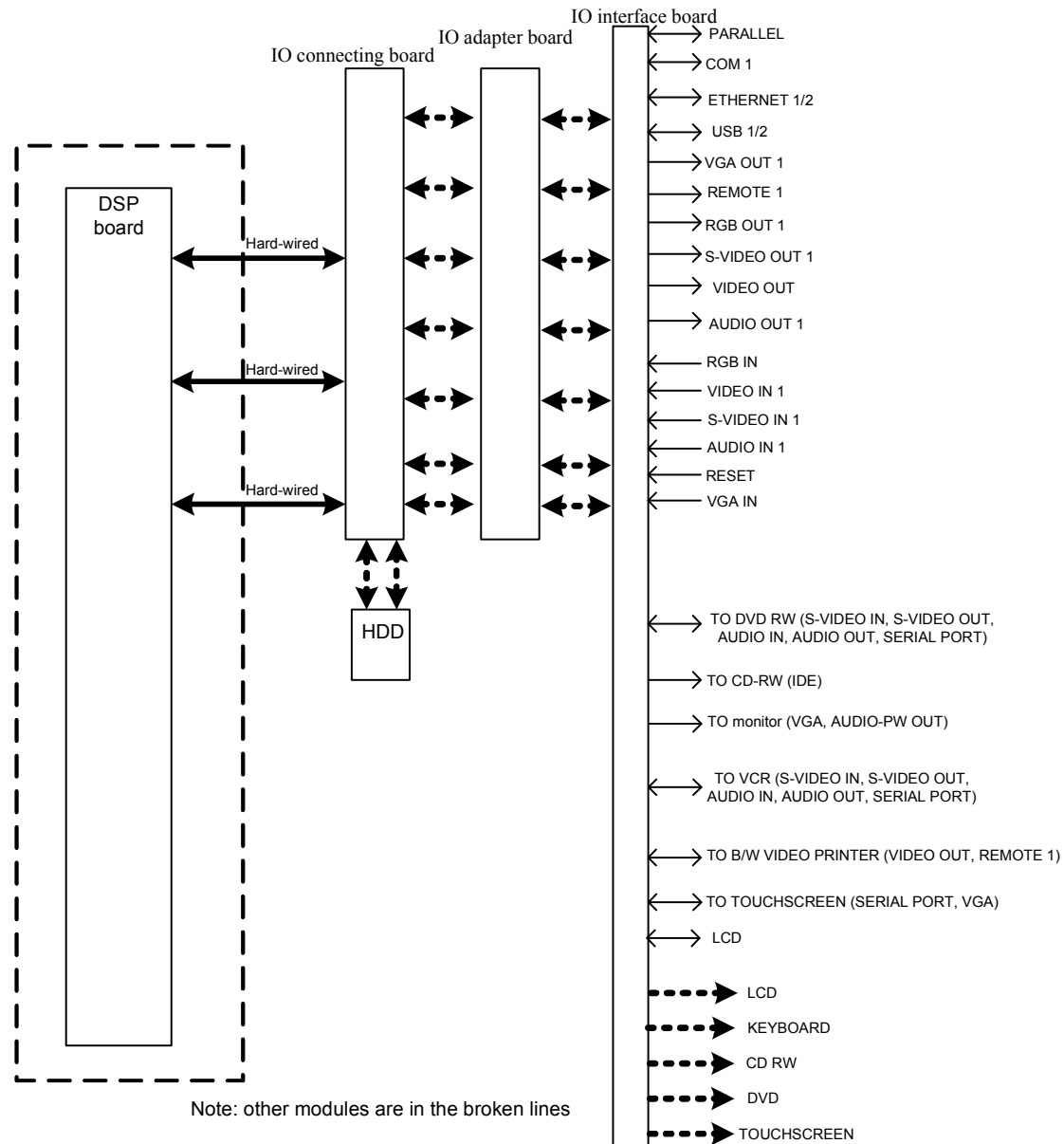
3.2.9 IO module

The IO module consists of IO connecting board, IO adapter board, and IO interface board.

The connection relation between these boards is shown as follows:

1. One end of the IO connecting board is connected to the DSP board, and the other end is connected to the IO adapter board; the standard 40PIN IDE HDD interface and 4PIN power interface are provided, and the power socket for HDD cooling fan is reserved.
2. One end of the IO adapter board is connected to the IO connecting board, and the other end is connected to the IO interface board; the adapter board serves as an extension board.
3. The IO interface board is connected to the IO adapter board, and provides IO interfaces and the power of the system; the IO interfaces are divided into internal IO (invisible for the user) and external IO (visible for the user).

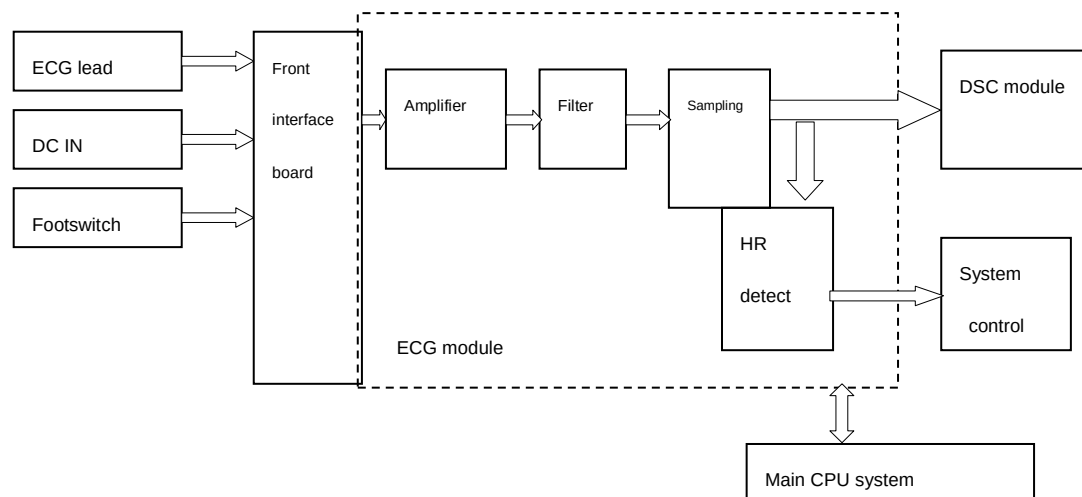
The block diagram of the IO module is shown as follows:



3.2.10 ECG module

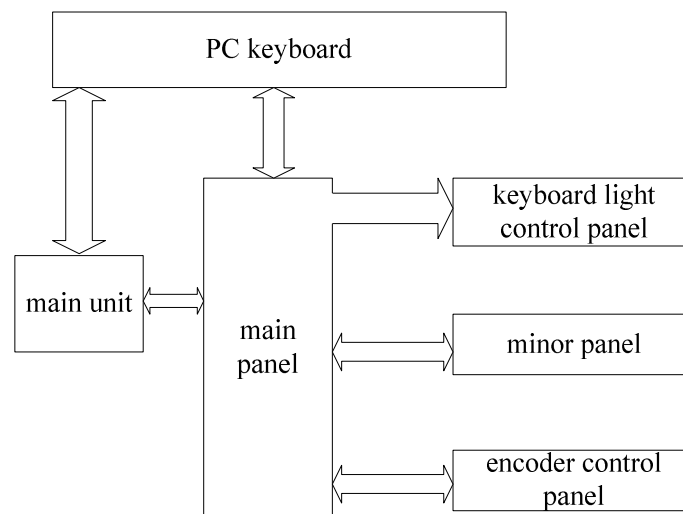
The ECG module is designed for monitoring of ECG signals and display of ECG waveforms, which serve as reference of ultrasound images. The ECG module can synchronously trigger display of 2-D images and color flow images. After the ECG signal is amplified, filtered and sampled, through the RS232 serial port, the signal is sent to the DSC module; at the same time the R-wave is detected, and the detected ECG-triggering signal is sent to the system controllers through interrupt, to start the scan transmission. The ECG module communicates with the main CPU system through the RS232 serial port.

The ECG signal can be inputted to the system, through an interface compatible with Mindray's monitoring products.

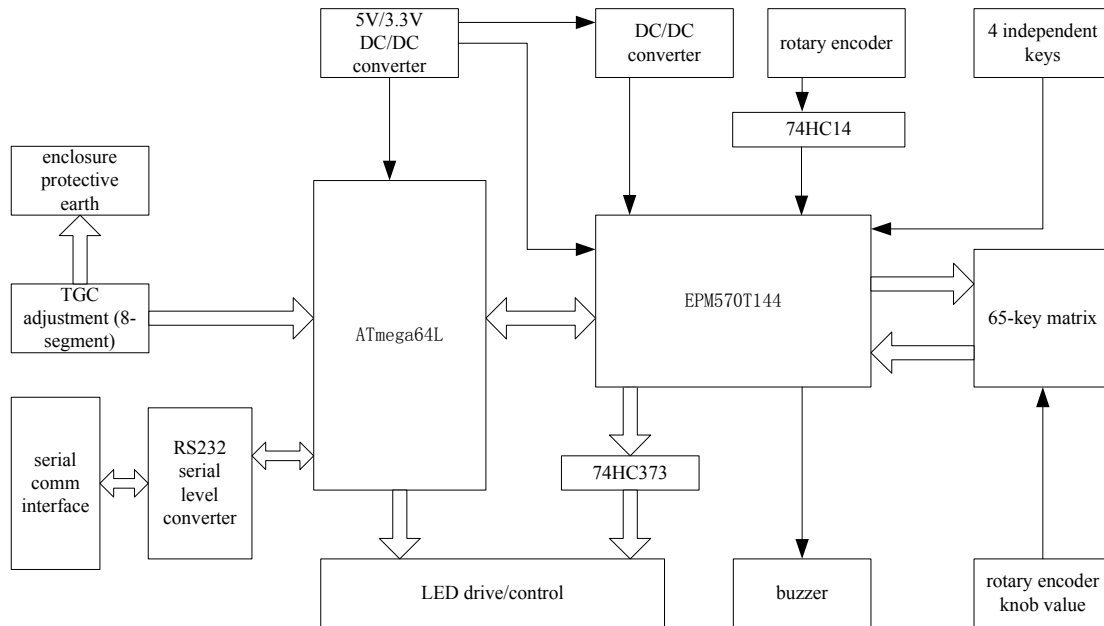


3.2.11 Control panels and keyboard

The control panels and keyboard are designed for key scanning, indicator control, buzzer control, receiving and processing for encoder data, STC data, PS/2 data, and they communicate with the main unit through serial ports. The control panels and keyboard consist of main panel, minor panel, encoder panel, and light control board, etc. The block diagram is shown as follows:



The block diagram of the main panel is shown as follows:



The keyboard plays an important role in information communication between the ultrasound system and environment, and on the basis of functions it consists of: CPU circuit, DC/DC conversion circuit, key control circuit, trackball control circuit, encoder control circuit, LED drive circuit and STC A/D sampling circuit. The CPU circuit consists of one MCU chip and the peripheral circuit, and it is the core of the keyboard, to process various types of information. The DC/DC circuit is used to provide different levels required by the keyboard. The key control circuit refers to the key processing hardware, which consists of CPLD and the peripheral circuit. The trackball control circuit and encoder control circuit are used to convert the external mechanical actions to signals which are recognizable by MCU, and the circuits consist of trackball, encoder, waveform shaping circuit and hardware processing circuit. The LED control circuit is used to indicate statuses of LEDs. The STC A/D sampling circuit consists of sliding potentiometer, amplifier and AD sampling circuit, and it is used to convert the analog signal from the sliding potentiometer to the digital signal which can be accepted by MCU.

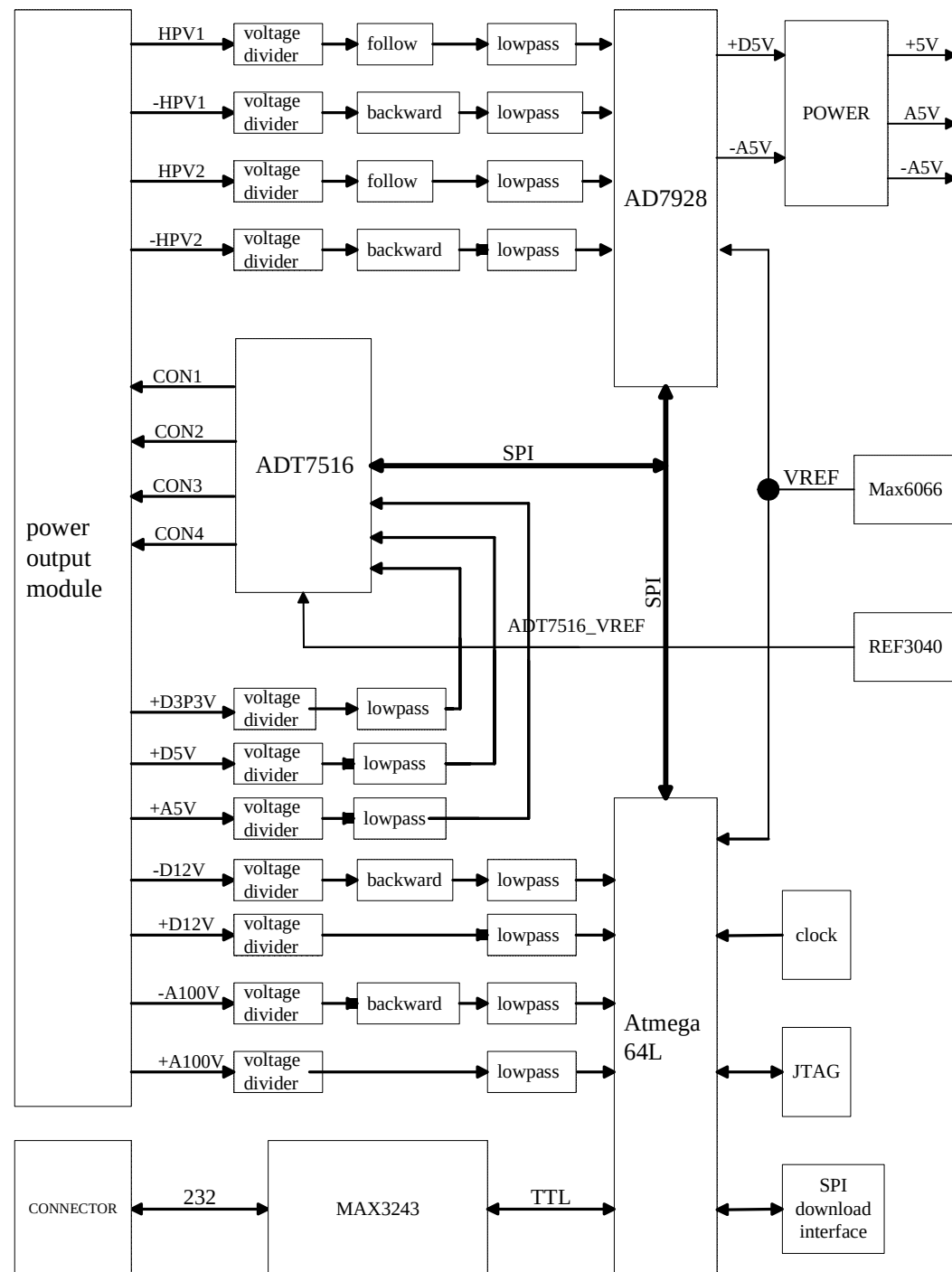
3.2.12 Detection board of Power Output

The detection board of power output is designed to precisely adjust the programmable high-voltage and monitor other output voltage.

The programmable high-voltage is divided into PHV1, -PHV1, PHV2 and -PHV2, and the adjustment ranges are between +5V and +80V and between -5V and -80V, and the adjustment precision is 1%.

For other voltages, the digital voltages include: D+12V, D+5V, D+3.3V and D-12V; the analog voltages include: A+100V, A-100V, A+12V, A+5V and A-5V.

The block diagram of the detection board is shown as follows:



3.2.13 CRT monitor

The CRT monitor is used to convert electric signal, transmitted from the main board, to high-speed electrons for impacting fluorescent screen, thus generating light signal to make images seen on the screen. The external indicator of the CRT is designed to judge if the monitor works normally. Generally if there is synchronous signal, this indicator is green; otherwise it is yellow.

3.2.14 LCD monitor

3.2.14.1 Components of LCD monitor module

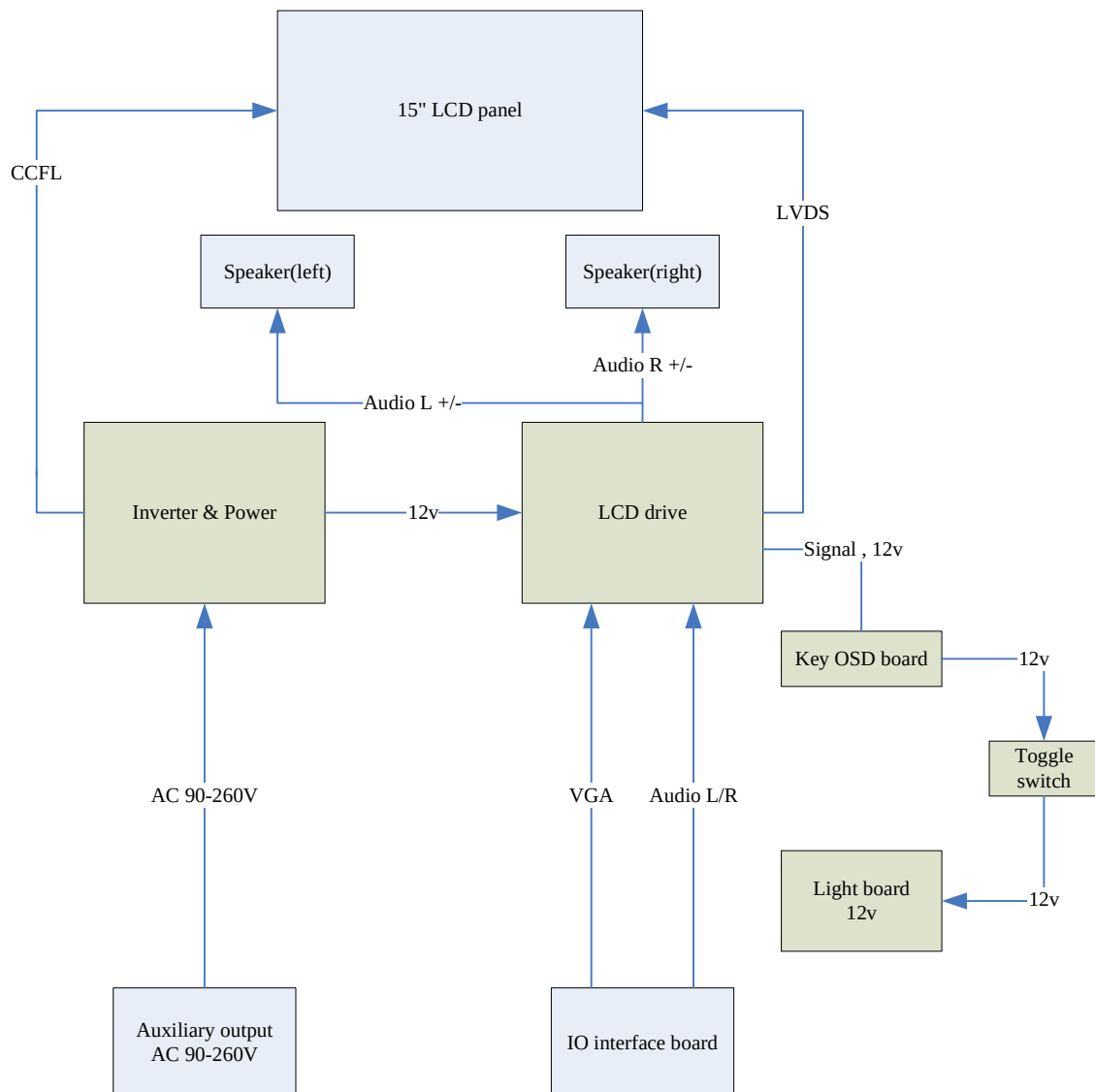
LCD module consists of 15 inch LCD display screen, boards and cards, wires and metal parts.

The components of the LCD module are shown as follows:

No	Components Name	Qty
1	15 inch TFT LCD PANEL-LQ150X1LW71N	1
2	15 inch LCD control board- LQ150X1LW71N	1
3	15 inch LCD LVDS connecting wire	1
4	Connecting wire between 15 inch LCD power board and drive board	1
5	15 inch LCD OSD board	1
6	15 inch LCD OSD connecting wire	1
7	15 inch LCD light board-12v	1
8	15 inch LCD power inverter board	1
9	15 inch LCD light switch and connecting wire	1
10	LCD fixing bracket	1
11	Reinforced plate	1
12	Shielding mask bracket	1
13	Left plate of shielding mask	1
14	Right plate of shielding mask	1
15	LCD fixing bracket	1
16	Wire strip CHS-3X80mm nylon	2
17	Cross panhead screw GB/T9074.8 M3X8 coated with rust-proof nickel	29
18	Aluminum sunk screw ϕ 3.2*7(GB/T 12617)	21

The 15 inch LCD display screen is a specified model, LQ150X1LW71N made by SHARP; the boards, cards and wires are customized according to structure and interface specifications.

3.2.14.2 Function diagram



3.2.14.3 Interface definition

Definition of LVDS signal output pins:

Drive voltage 3.3V, LVDS interface.

PIN	SIGNAL	PIN	SIGNAL
1	VCC	11	RX2-
2	VCC	12	RX2+
3	GND	13	GND
4	GND	14	CK-
5	RX0-	15	CK+
6	RX0+	16	GND

7	GND	17	RX3-
8	RX1-	18	RX3+
9	RX1+	19	GND
10	GND	20	GND

Definition of speaker signal pins:

PIN NUMBER	SIGNAL
1	L-SDBX+
2	L-SDBX-
3	R-SDBX+
4	R-SDBX-

Definition of VGA signal pins:

PIN NUMBER	SIGNAL
1	VSYNC
2	GND
3	HSYNC
4	GND
5	RED
6	BLUE
7	GREEN
8	GND
9	GND
10	GND

Definition of AC input pins:

PIN NUMBER	SIGNAL
1	L
2	N
3	GND

3.3 Power Supply Principle

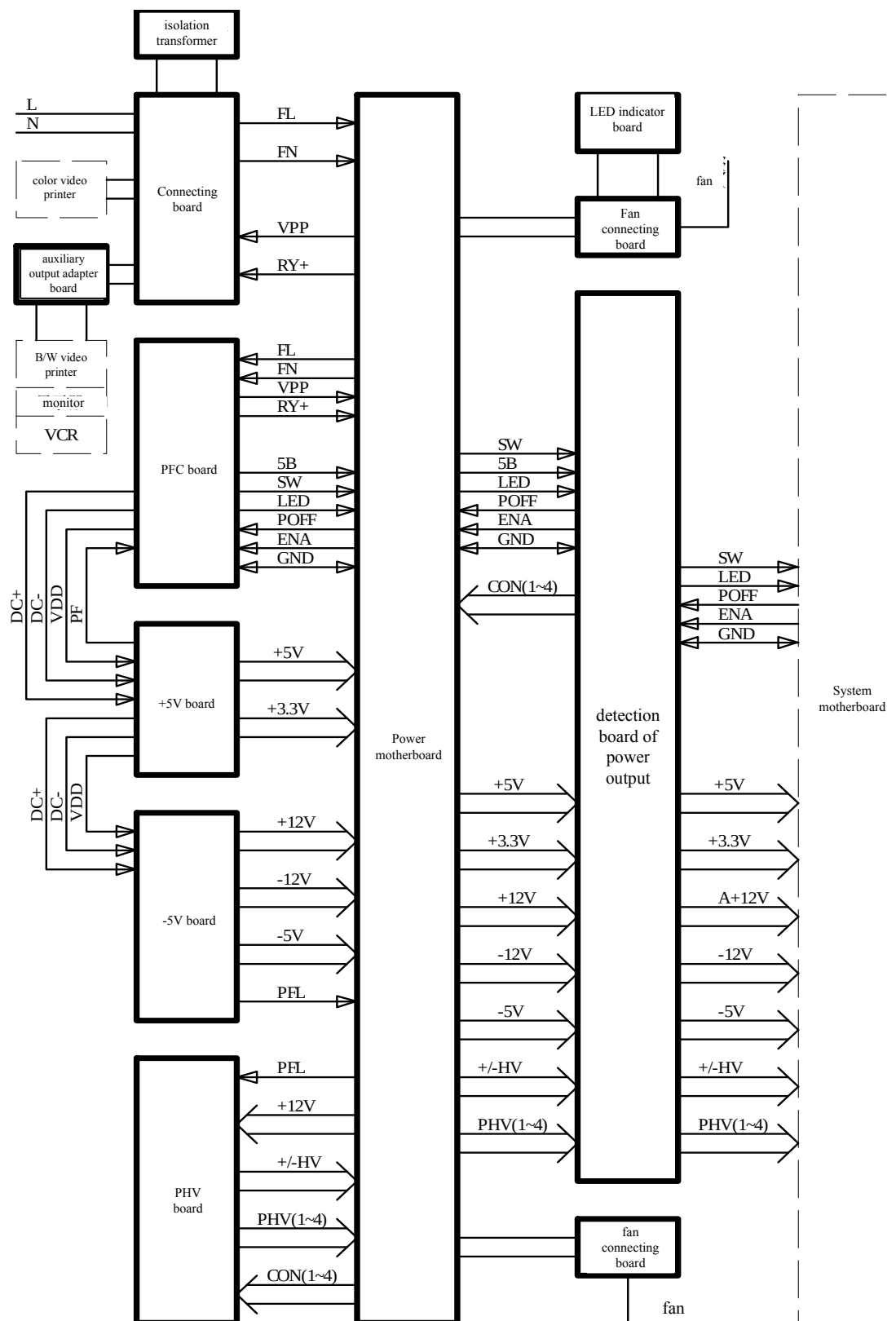
3.3.1 Power supply system

The power system consists of connecting board, PFC board, +5V board, -5V board, PHV

board, adapter board of auxiliary output, LED board, adapter board of fans, power motherboard and detection board of power output.

The AC line power passes the circuit breaker to enter the connecting board, and then, through the isolation transformer, two isolated outputs are obtained. After filtered, one output serves as AC auxiliary output for the monitor and printers, the other passes the power motherboard to become the input power for the PFC board. After entering the PFC board, the power is converted to a stable 390V high-voltage DC output through the BOOST PFC, and then provided for the +5V board and -5V board to finally output +5V, +3.3V, -5V, 12V and -12V. The 12V serves as the input power of the PHV board, and it passes the FLYBACK converter in the PHV board to output $\pm 100\text{V}$ voltages; four programmable voltages are obtained through the BOOST converter and BUCK-BOOST converter.

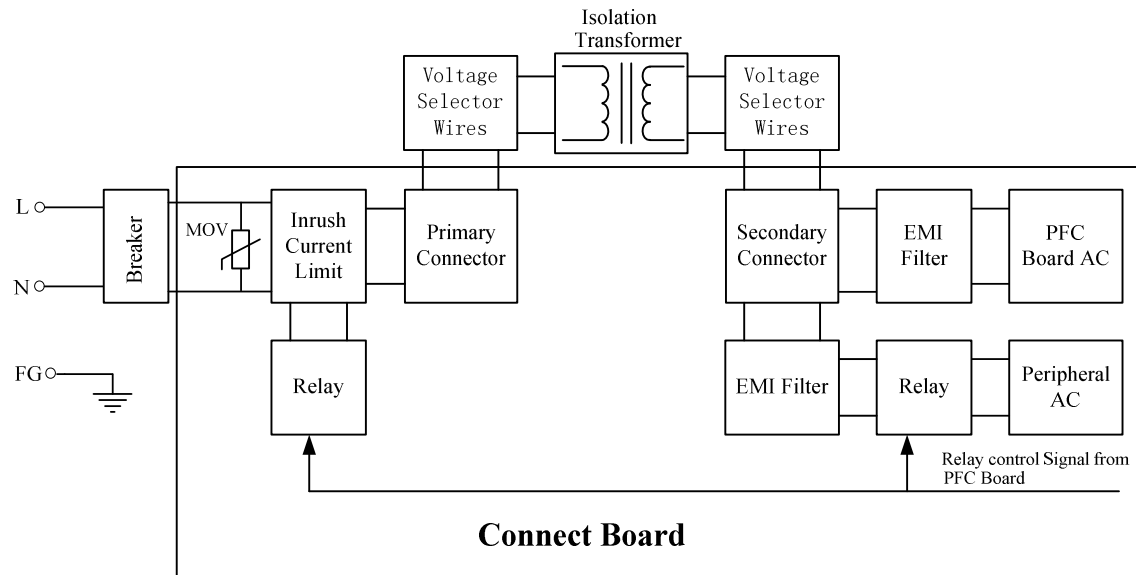
After passing the power motherboard, the outputs of the power system are connected to the detection board of power output for filtering and monitoring. After the programmable voltages are detected, they are outputted to the main unit for supplying power for relevant hardware circuits. The outputs of the power system, after passing the fan adapter board, are connected to the LED board. The LED board indicates the statuses of the outputs.



3.3.2 Principle of power boards

3.3.2.1 Connecting board

The block diagram of the connecting board is shown as follows.



The line power input passes the circuit breaker to enter the connecting board, passes the surge current rejection circuit to reach an isolation transformer, and then the isolation transformer generates two AC outputs which are isolated with the line power. After passing one-level or multiple-level EMI filter, one output provides power for the PFC board, and the other, through relay control, provides power for the monitor and printer. The high and low voltages of the line power are selected by tieline of the transformer. After the system is turned on, the PFC boards sends the relay shut-off signal, and bypasses the thermistor rejecting surge current, and the AC auxiliary output is switched on.

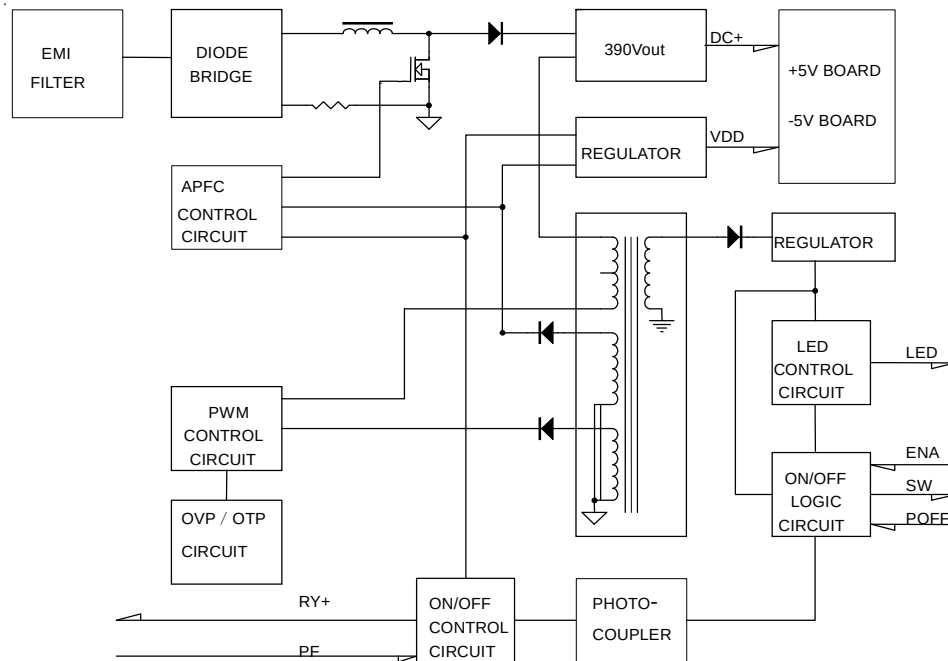
3.3.2.2 PFC board

The PFC board consists of APFC power circuit, STANDBY power, control circuit of soft switch, LED indicator circuit and protection circuit. The diagram is shown as follows.

The AC input power passes the EMI filter, and then passes the rectifier bridge to reach the BOOST APFC power circuit. In the APFC control circuit, the APFC function of the input power is completed, and a stable +390V DC current is outputted to the +5V board and -5V board. The APFC control circuit is powered by the STANDBY power supply. The structure of the STANDBY is single-end FLYBACK converter. The STANDBY not only provides +18V power VCC for the APFC control circuit, but also outputs an isolated +5V voltage for control circuit of soft switch and LED control circuit.

Besides OVP and OTP, the PFC board receives the fail protection signal PF from the +5V board, the soft turn-off signal POFF and turn-off enable signal ENA, thus realizing the safe turn-off of the entire power system.

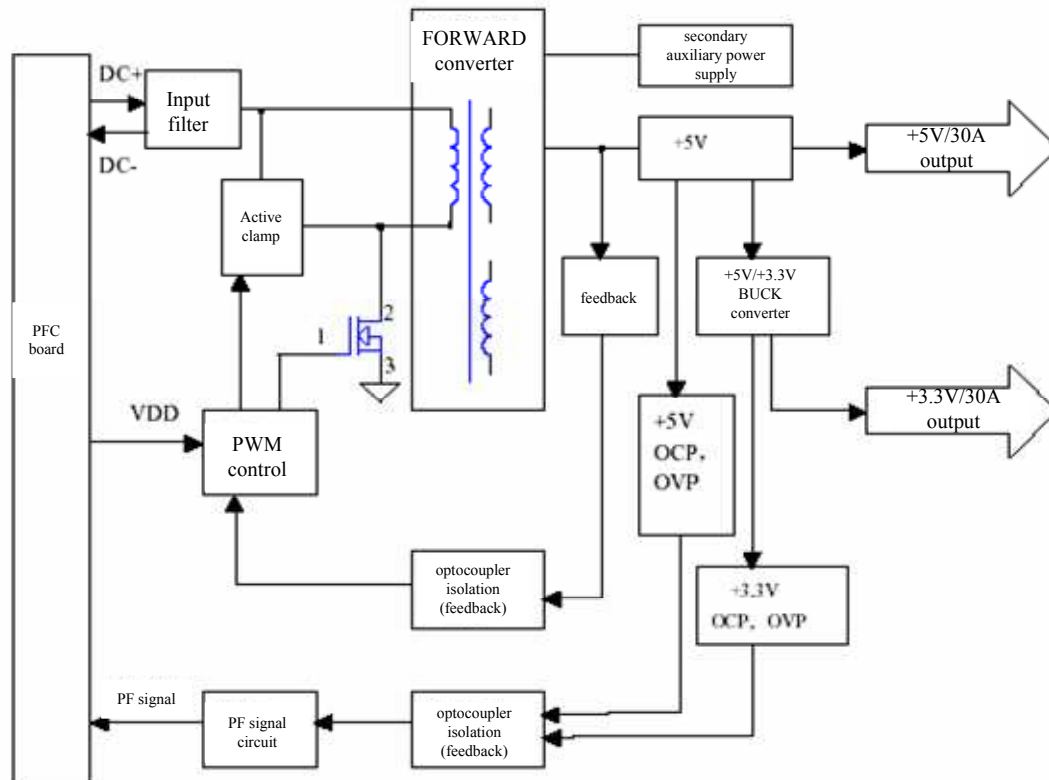
The core ICs of the PFC board, PFC controller and PWM controller, are respectively UC3854 and 38HC43 made by TI.



3.3.2.3 +5V board

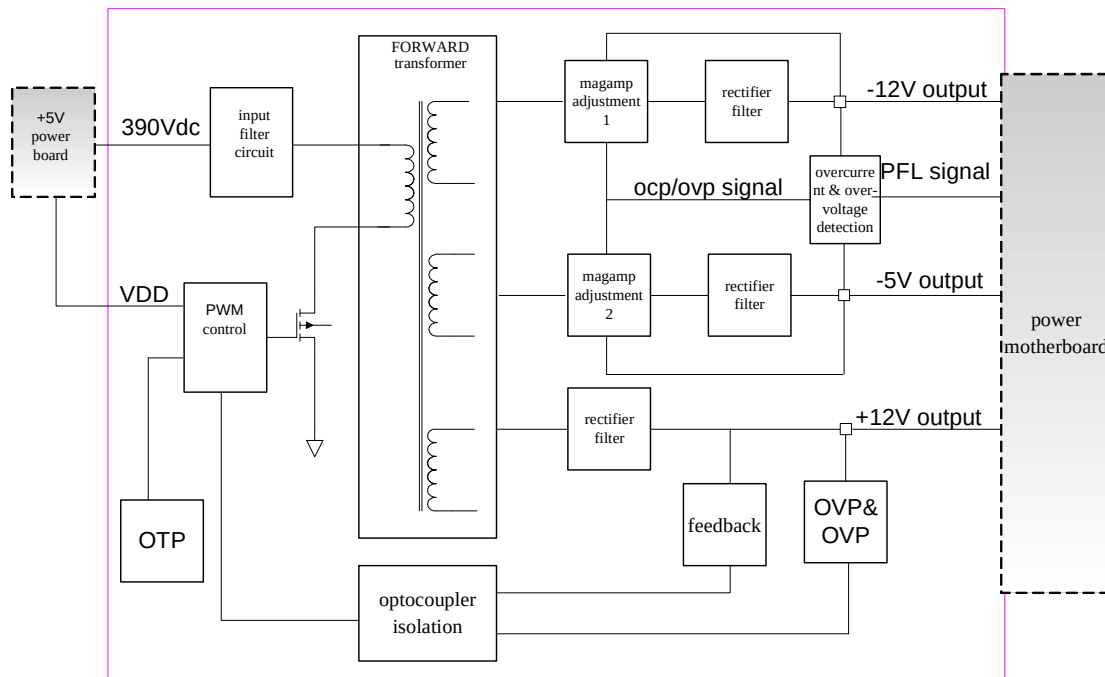
The structure of the +5V board is single-end forward active-clamp conversion.

The DC input voltage passes a LC filter and is sent to a transformer, and then passes PWM control and is converted to square-wave voltage. After the square-wave voltage passes a rectification filter, the stable +5V DC voltage is outputted. The duty cycle of PWM controller is adjusted by error-amplifying signal of feedback network and transmission of a photocoupler. The +5V passes a BUCK converter to output the +3.3V, and the control IC of the BUCK converter is LTC1629EG made by LINEAR. The control IC of the PWM is U9, i.e., UCC2894 made by TI, and the switching tube is 2KS2611 made by TOSHIBA.



3.3.2.4 -5V board

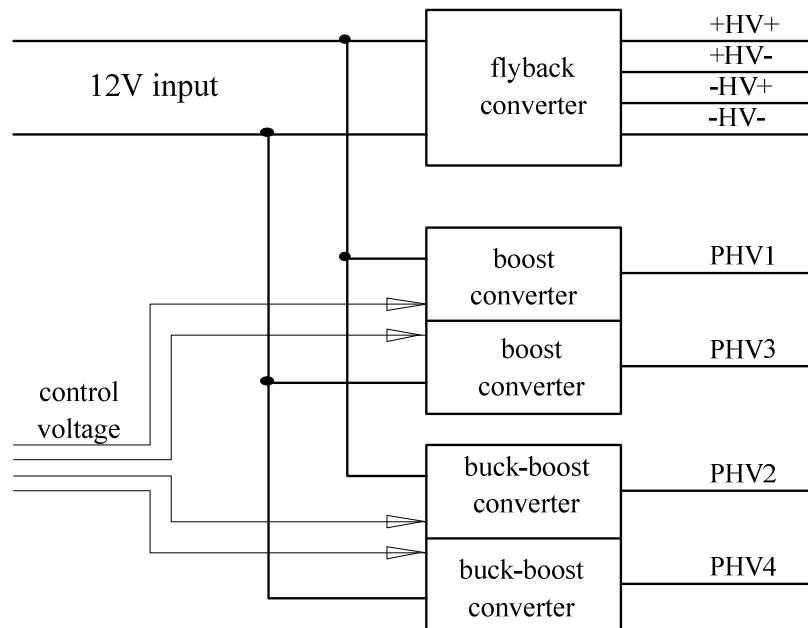
The -5V board adopts the structure of single-end forward converter, and its block diagram is shown as follows. The 390Vdc input enters the power board through the +5V board and a connector, and it passes the LC filter to become the input of the FORWARD converter. After passing the FORWARD converter, the DC voltage is converted to stable DC outputs of +12V, -5V and -12V. The +12V is the main feedback output of the converter, the other two are auxiliary outputs, and adjustment of magnetic amplifier is used as stabilizing method.



3.3.2.5 PHV board

After the 12V input voltage enters the PHV, it passes the FLYBACK converter to generate two groups of positive and negative high voltages. After the 12V input voltage passes the BOOST converters and BUCK-BOOST converters, PHV1, PHV3, PHV2 and PHV4 are outputted.

The control IC of the FLYBACK converter is UC3843 made by ONSEMI, and the main switching tube is IRF3710 made by IR (100V/60A). The control IC of the BOOST converter is TL594 made by ONSEMI, and the switching tube is IRF52N15DPBF made by IR (150V/60A). The control IC of the BUCK-BOOST converter is MAX1847 made by MAXIM, and the switching tube is IRF6215PBF made by IR (150V/13A). The output voltage values have linear relation with the programmable voltages. When the programmable voltages vary within the range of 0 and 4V, the absolute values of the output voltages vary within the range of 5 and 80V.



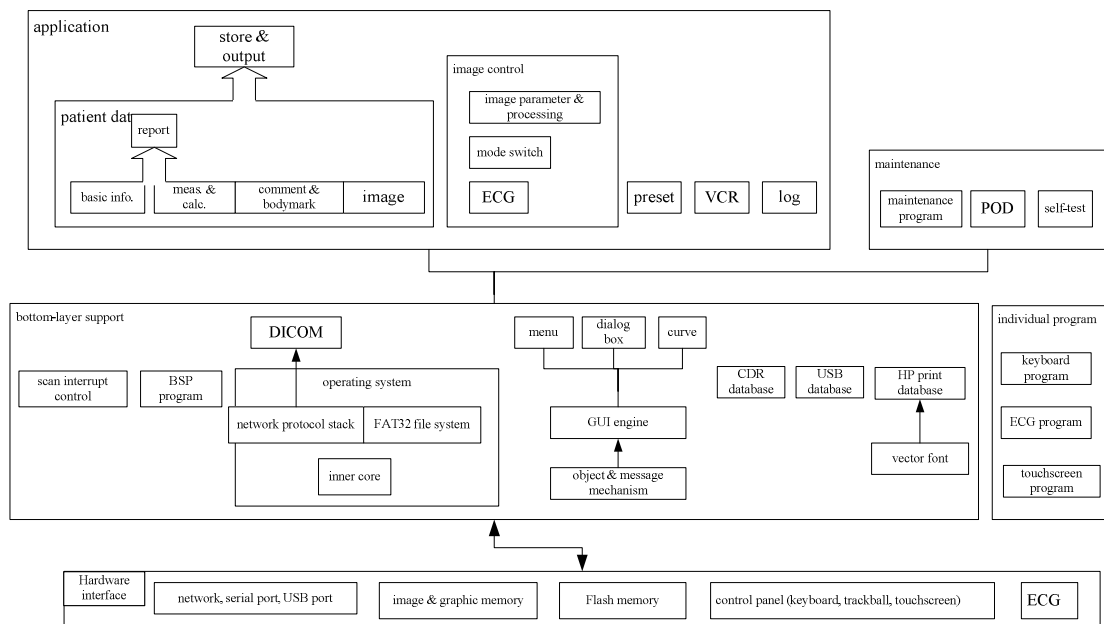
3.3.2.6 Other boards

The principle of other boards is simple and all components on the boards are almost passive, so it isn't necessary to describe it.

3.4 System Software

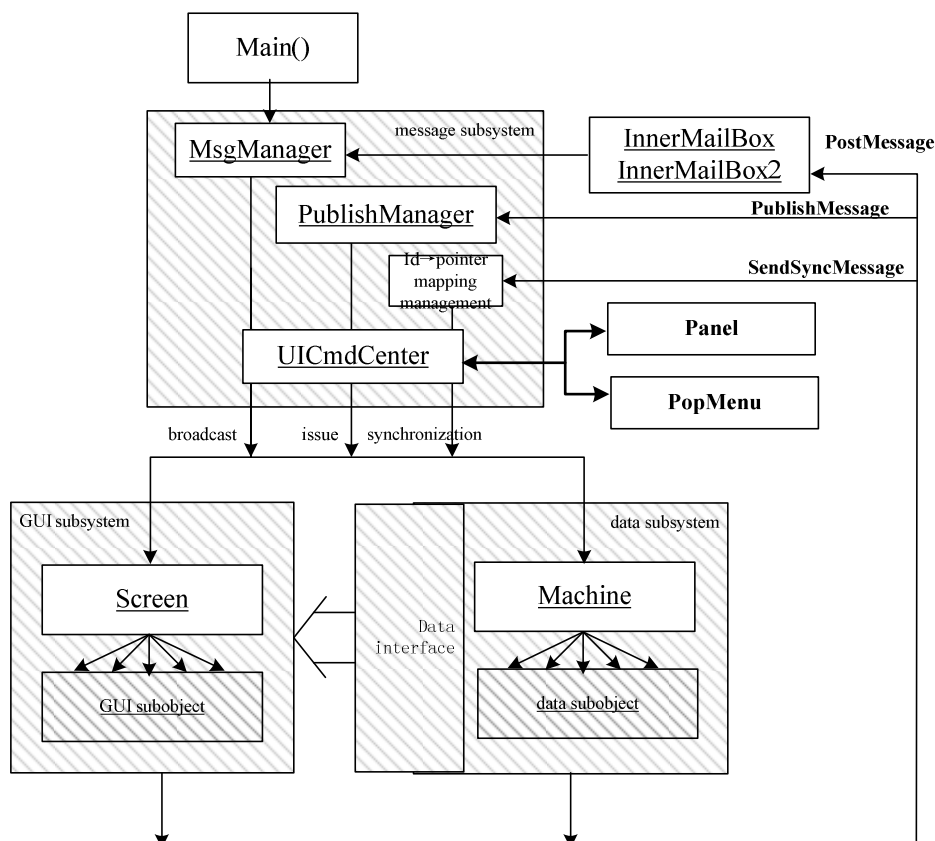
3.4.1 Structure

The system software consists of hardware interface layer, medium support layer and upper software layer. The upper software is comprised of patient information management system, measurement and calculation, image mode control, peripheral control and preset, etc.



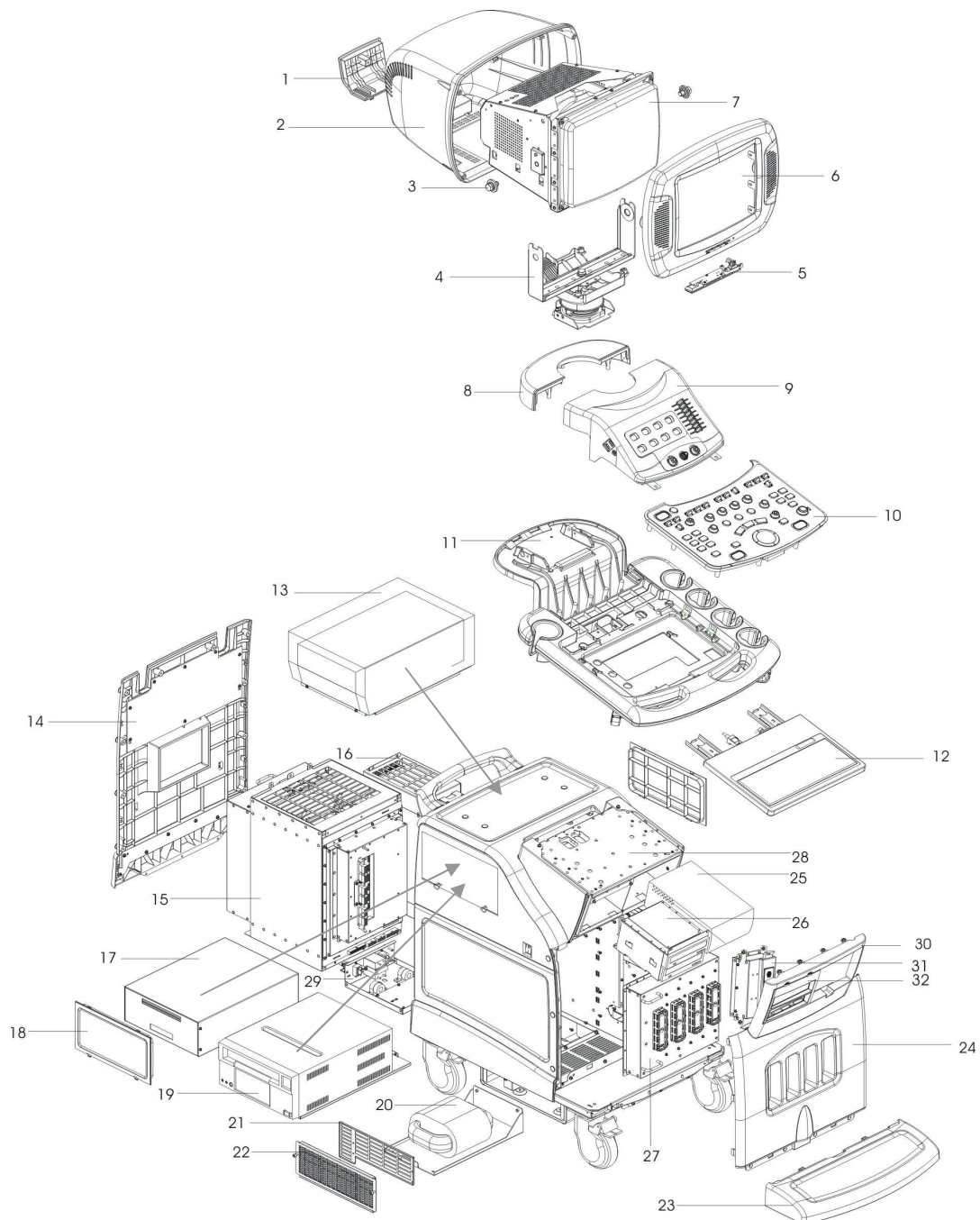
3.4.2 Principle

The entire software system runs through asynchronous processing mechanism of message control. Commands are entered through GUI system and control panel, and stored in mailboxes, so that the software system can obtain the commands from the mailboxes to interpret and execute.



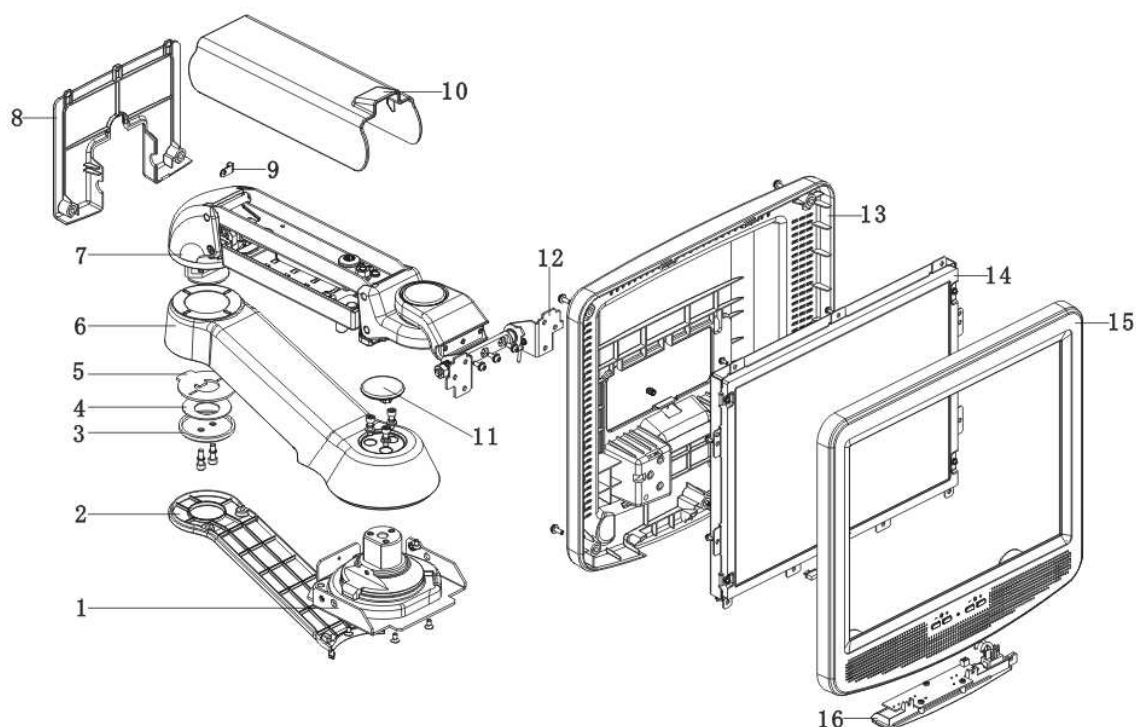
4 System Structure and Assembly/Disassembly

4.1 Exploded View of Complete System



No	Part Number	Name	No	Part Number	Name
1	2105-20-40185	monitor tail cover	17	2105-30-40252	DVD assembly (optional)
2	2105-20-40184	monitor rear cover	18	2105-20-40159	VCR cover plate
3	2105-20-40198	Up/down pin roll	19	2105-30-40376	VCR assembly (optional)
4	2105-30-40392	Monitor supporting and moving assembly	20	2105-20-40120	R1000 transformer (1000VA)
5	2105-30-40389	Bottom light assembly	21	2105-20-40238	Transformer partition
6	2105-30-40390	monitor front cover	22	2105-20-40170	Air inlet dust net
7	2105-21-85992	Monitor CRT assembly	23	2105-30-40360	main unit paddle assembly
8	2105-30-40437	minor panel rear cover assembly	24	2105-30-40359	main unit front cover assembly
9	2105-30-40386	minor panel assembly	25	2105-30-40373	video printer assembly (optional)
10	2105-30-40385	main panel assembly	26	2105-30-40375	DVD-R/W assembly
11	2105-30-40388	keyboard support assembly	27	2105-30-40370	System transducer assembly
12	2105-30-40387	keyboard assembly	28	2105-30-40366	main unit housing assembly
13	2105-30-40374	color printer assembly	29	2105-30-40382	power input assembly
14	2105-30-40358	main unit rear cover assembly	30	2105-30-40361	main unit neck front cover assembly
15	2105-30-40367	System main unit box assembly	31	2105-30-40380/ 2105-30-40489	ECG assembly (Chinese/English)
16	2105-30-40363	Power main unit box assembly	32	2105-20-40164	DVD-R/W front cover

4.2 Exploded View of LCD Monitor and Support Arm



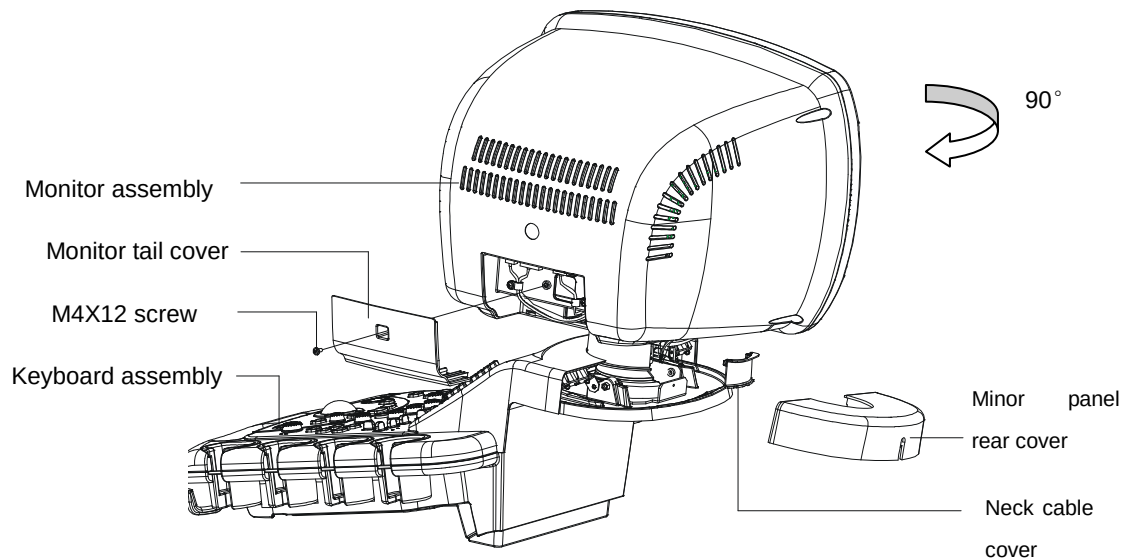
No	Part Number	Name	No	Part Number	Name
1	2111-30-73327	Base assembly	9	6200-10-09762	Ground wire strip
2	2111-20-73283	Lower support arm cover	10	043-000395-00	Upper support arm
3	2111-20-73313	Press block of upper support arm gyration	11	2111-20-73285	Rubber cover
4	M6T-020002---	Dish spring, series 3 D=50	12	2111-20-73325	Damp axis
5	2111-20-73296	Washer of upper support arm gyration	13	2111-20-73288	Rear cover of monitor
6	2111-30-73328	Assembly of lower support arm	14	2111-20-73336	Monitor module (Jufeng)
7	115-003067-00	Assembly of upper support arm	15	2111-30-73334	Front cover assembly
8	2111-20-73289	Cable cover of monitor	16	2111-30-73335	Bottom light assembly (included in front cover assembly)

4.3 Disassembly and Replacement

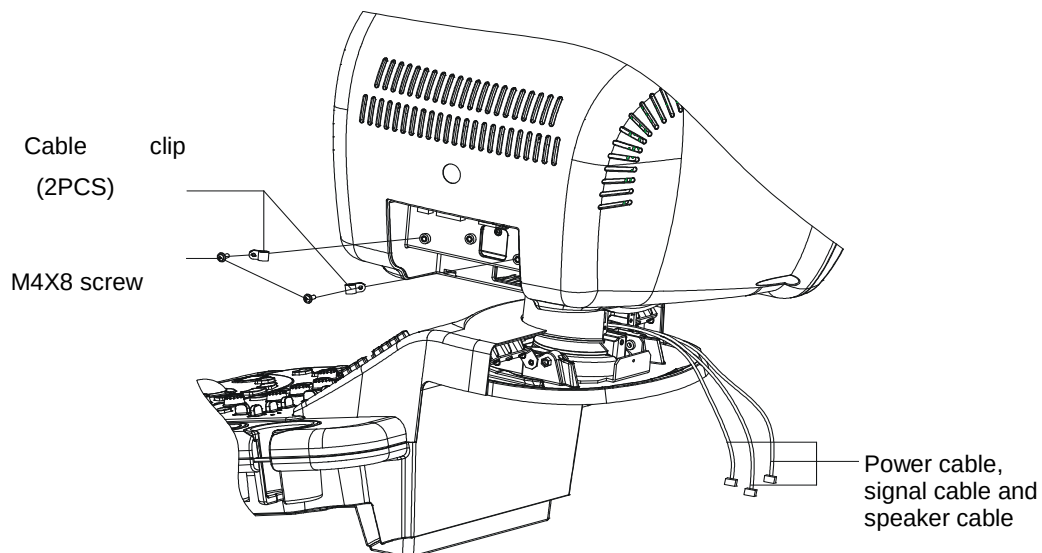
4.3.1 Disassembly of the monitor

4.3.1.1 Disassembly of CRT monitor

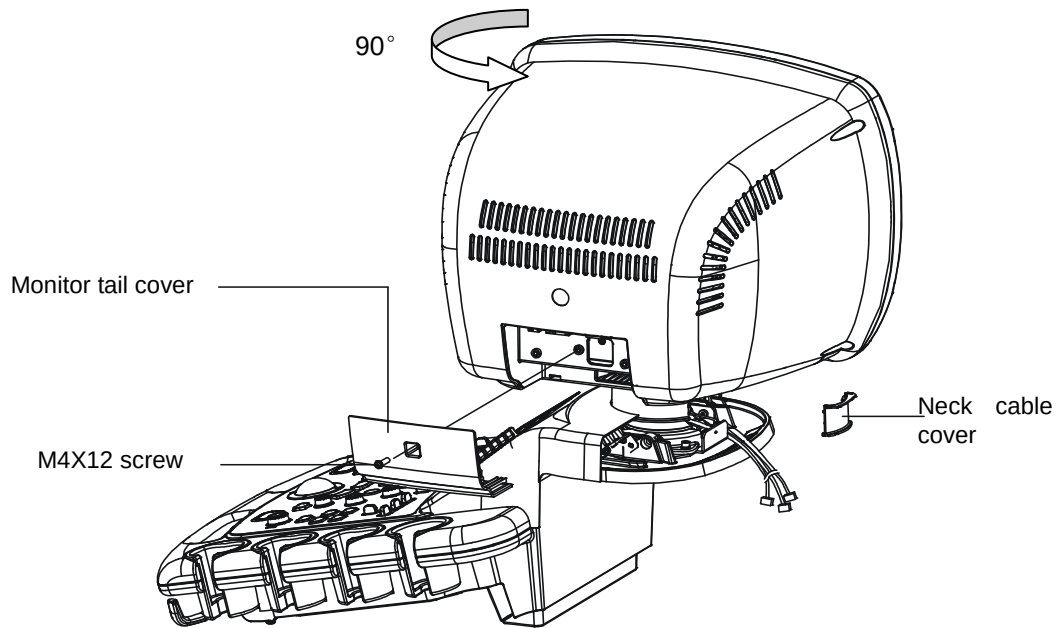
- a) Remove the monitor tail cover and minor panel rear cover, and rotate the monitor 90° clockwise, and remove the neck cable cover.



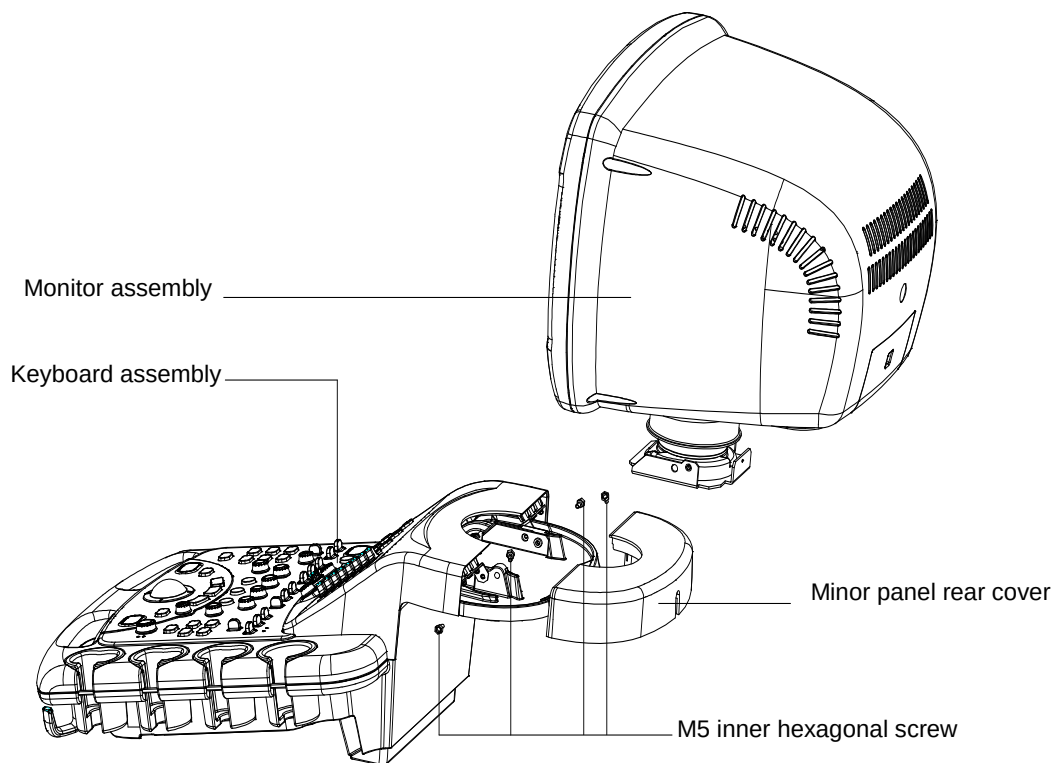
- b) Remove the cable clip, disconnect the cables and take them out of the rear cover and neck cover.



- c) Assemble the neck cable cover and monitor tail cover, and rotate the monitor 90° counterclockwise.



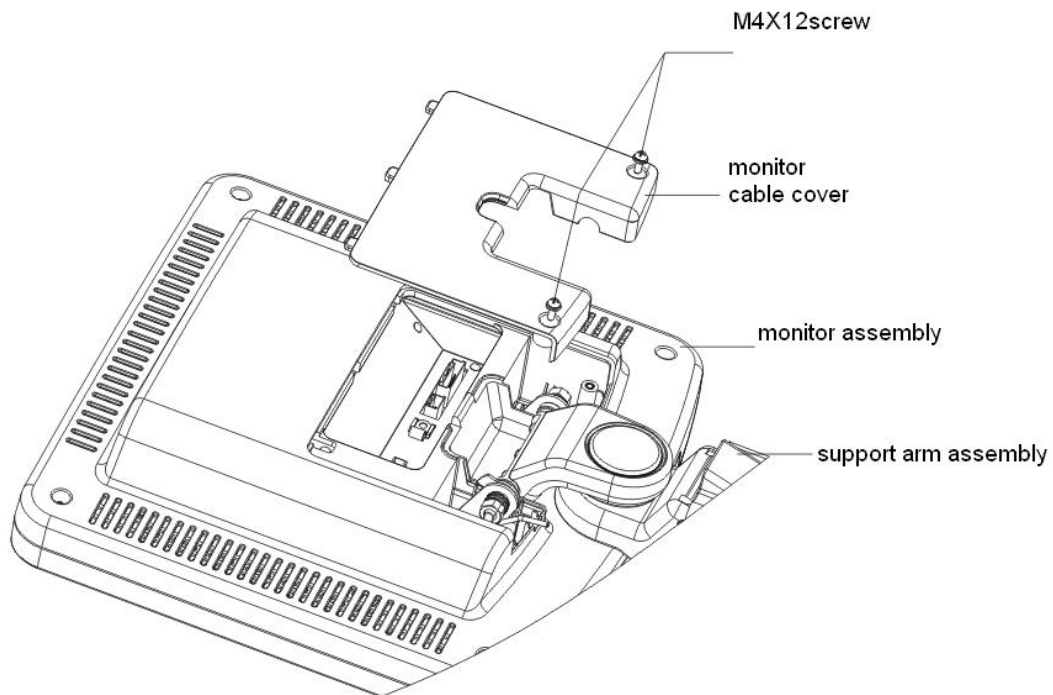
- d) Loosen the screws fixing the monitor in two sides and back side, remove the monitor assembly, put the cables inside the keyboard assembly, and install the minor panel rear cover.



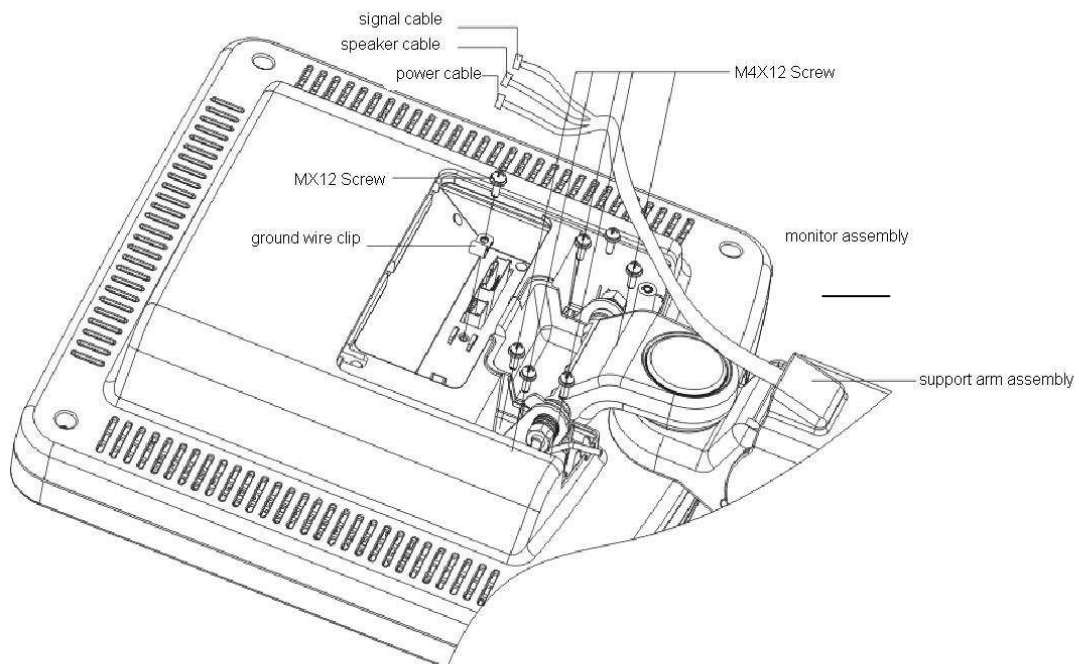
4.3.1.2 Replacement of LCD monitor

- 1) Lock up the upper support arm. Refer to Chapter 2.
- 2) Remove the cable cover.

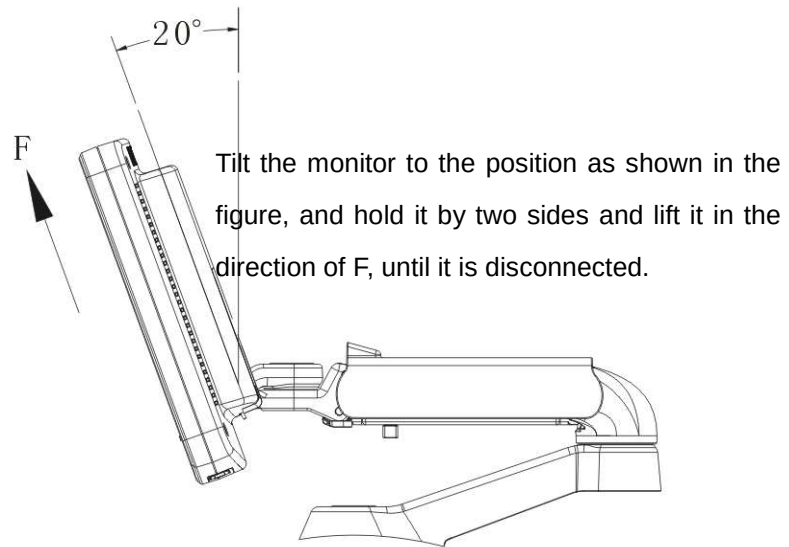
Toggle the lever to tilt the monitor to the horizontal position (refer to Chapter 2).



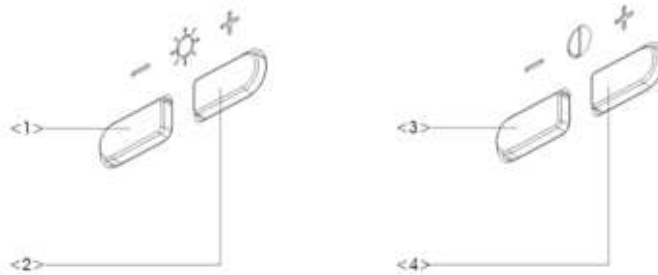
- 3) Remove the wire strip screws and cable connector, and remove the six screws fixing the monitor.



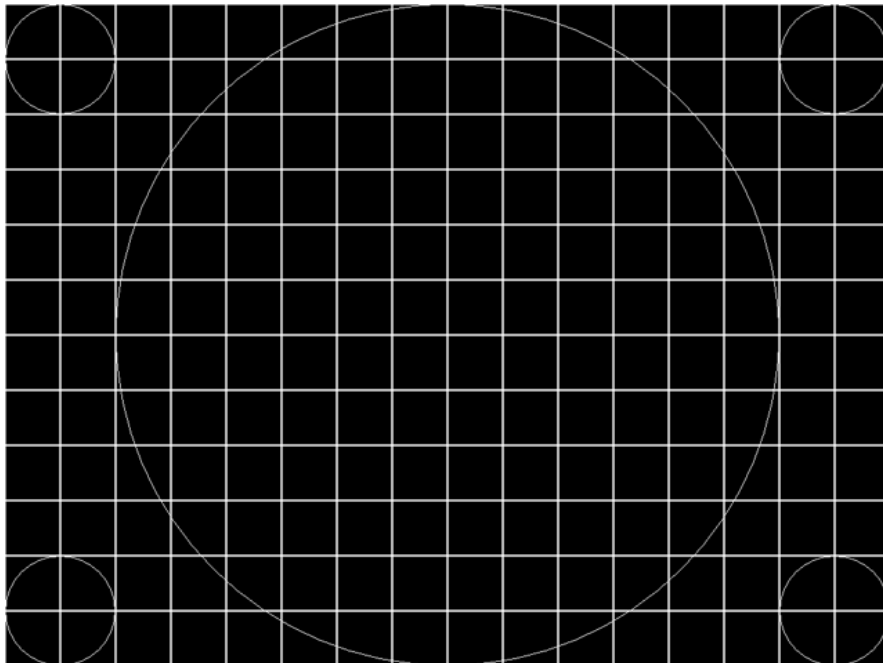
- 4) To remove the LCD monitor from the support arm, lift it first and then disconnect it from the hook.



Adjust the LCD monitor after changing or replacing the main board:



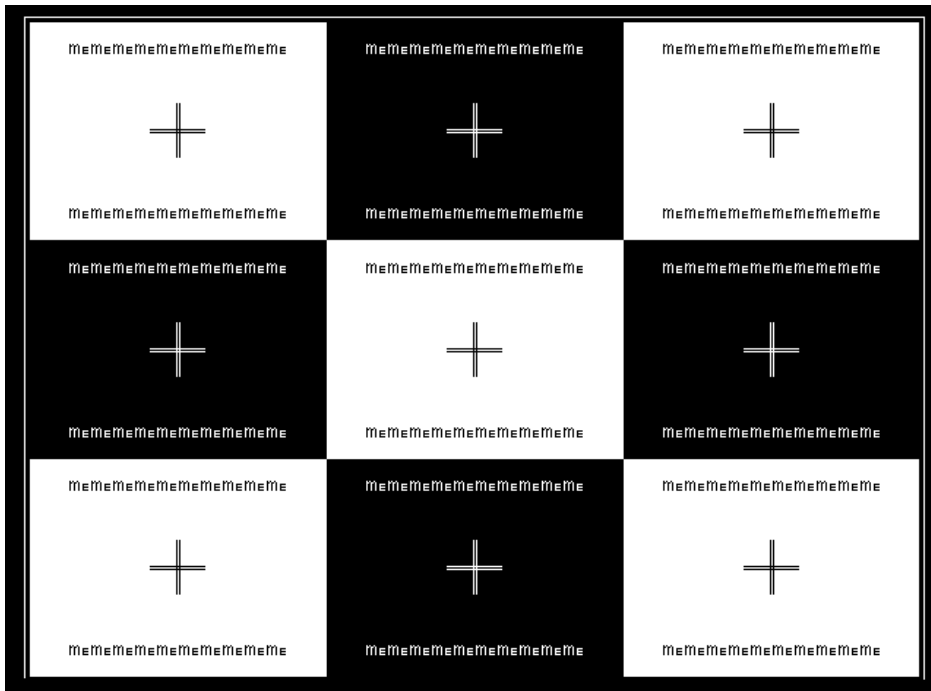
- Follow step 1, 2 and 3 in section 7.2.3.1 to enter the System Maintenance Menu and select the Monitor Test item.
- Press the left direction key on the minor keyboard to display the following screen.



Press <1> and <4> buttons and hold for at least 3s until the blue menu displays on the screen, select "autojust" via button <1> and <2>, and press <4> to confirm; the image

jitters for about 5s before you can switch the screen.

- c) Press the right direction key on the minor keyboard to display the following screen.



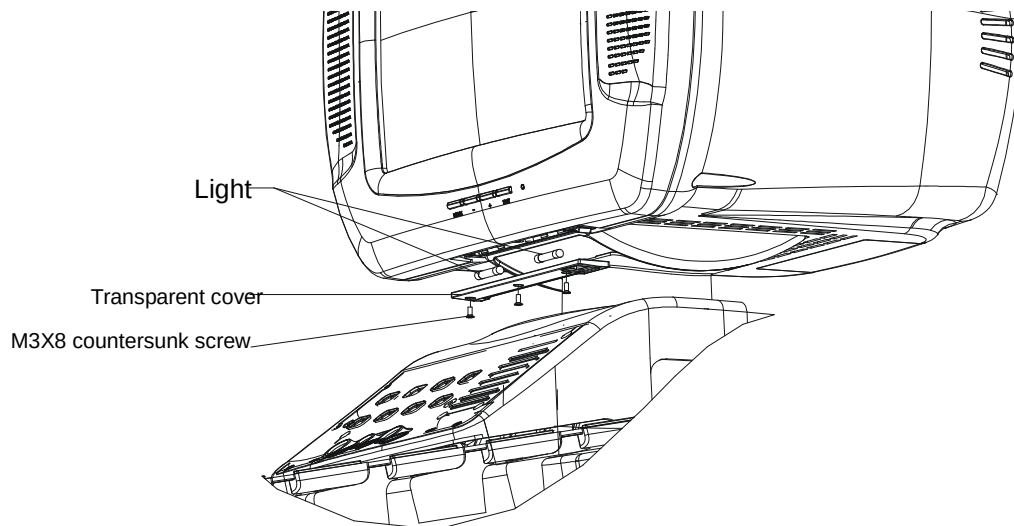
Select “autocolour” on the upper screen, the color changes for 5s before you can select “exit” to leave the screen.

NOTE: in “autojust” and “autocolour” tests, the monitor captures the output signal of the product, based on which to adjust the position and color of the monitor.

4.3.2 Replacement of the bottom light

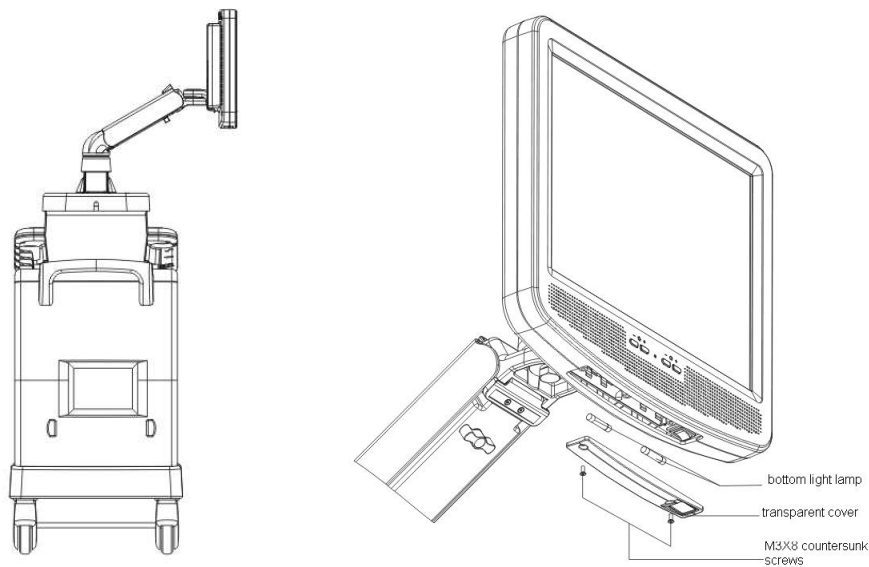
Replacement of CRT monitor bottom light is described as follows:

- d) Remove three M3X8 countersunk screws and the transparent cover of the bottom light.
- e) Gently take out the light and replace it with a new one.



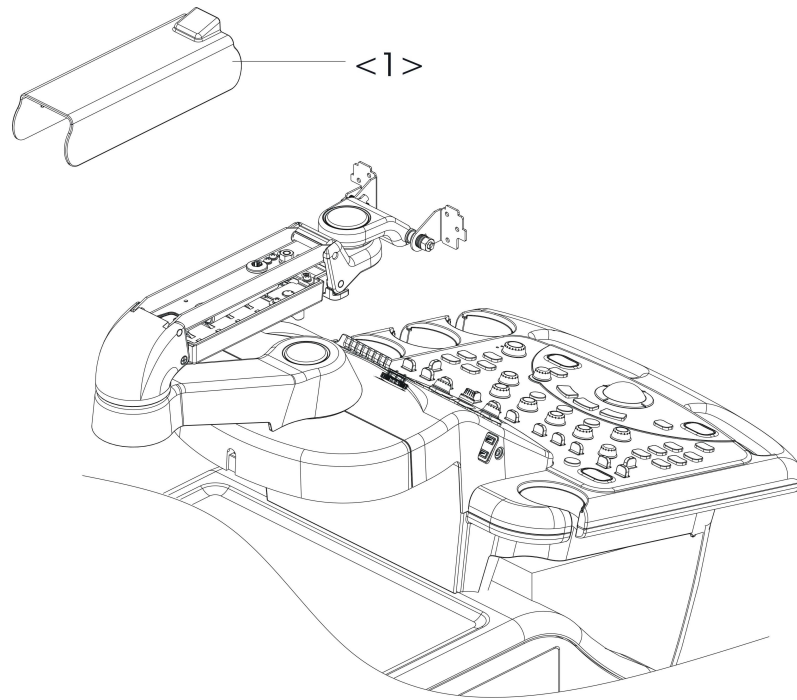
Replacement of LCD monitor bottom light is described as follows:

- Swivel the monitor to one side of the machine (as shown in the figure below);
- Remove two M3X8 countersunk screws to remove "transparent cover".
- Remove the old lamp and replace it with new one.



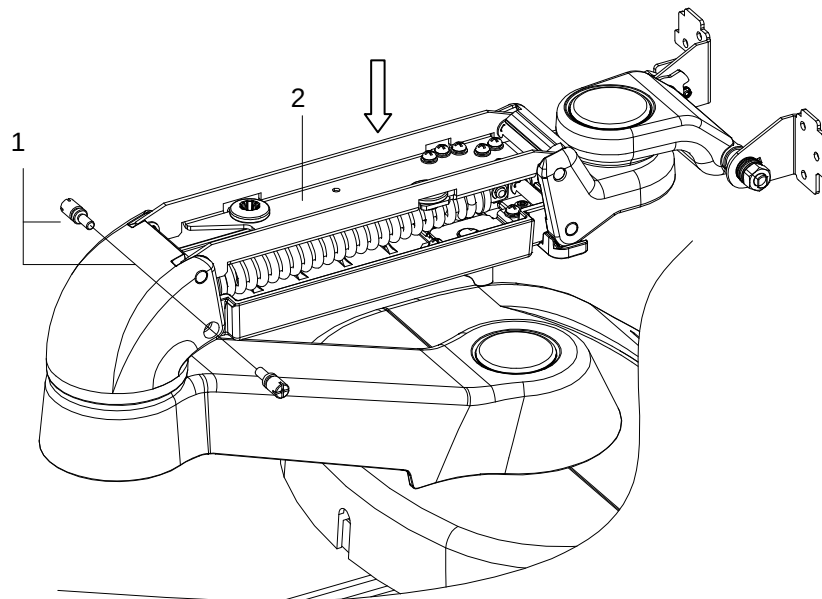
4.3.3 Replacement of spring damping parts

- Lock up the four casters;
- Perform step 4.3.1.2 to remove the monitor;
- Remove the upper support arm cover;



1. Upper support arm cover

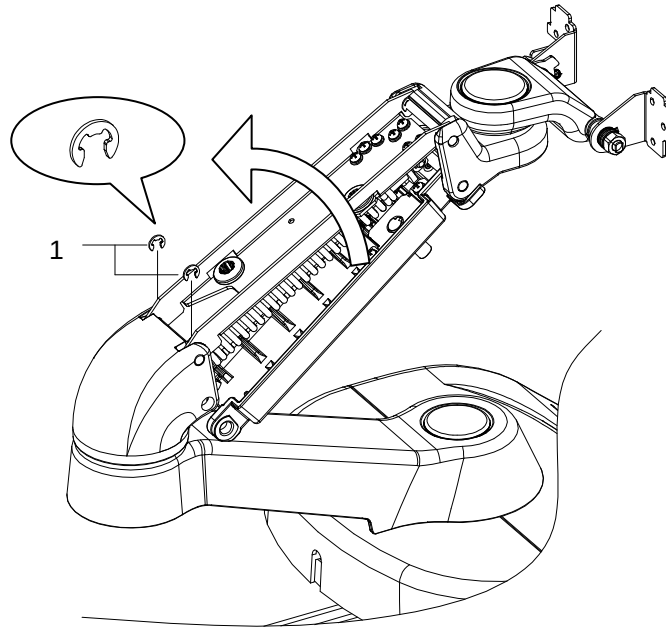
- 4) Press the upper support arm, and remove the screw pins and the M5 spring washers with a Philips screwdriver;



1. Screw pins & M5 spring washer

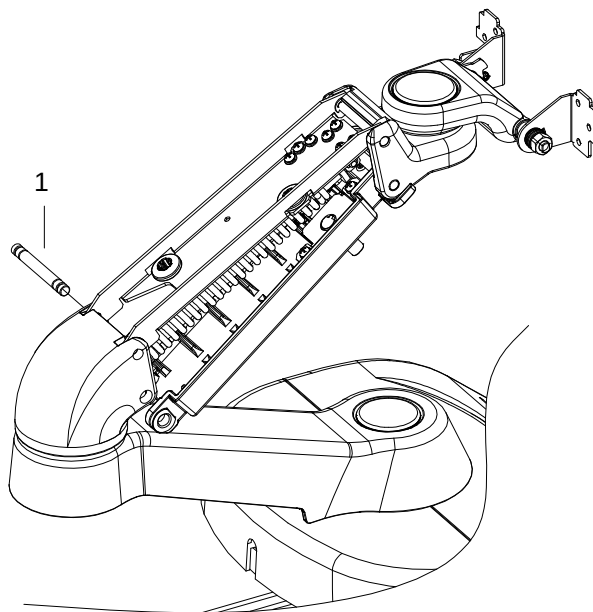
2. Upper support arm

- 5) Lift the support arm upward to the extreme position, and then remove the two retainer rings at the end of the parallel bracket of the upper support arm.



1. Retainer ring

6) Hold the support arm to lift it and push the cross-pin out from one side.

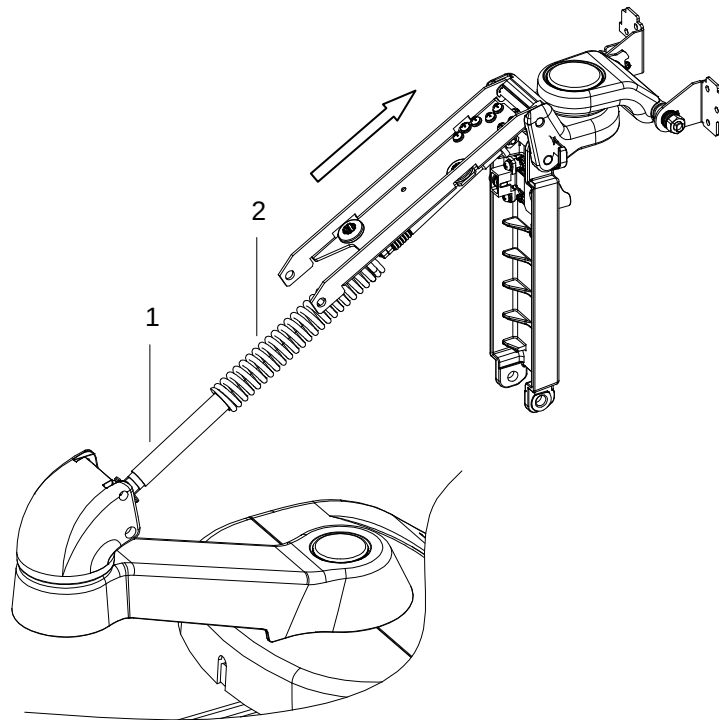


1. Cross-pin of the upper support arm

NOTE:

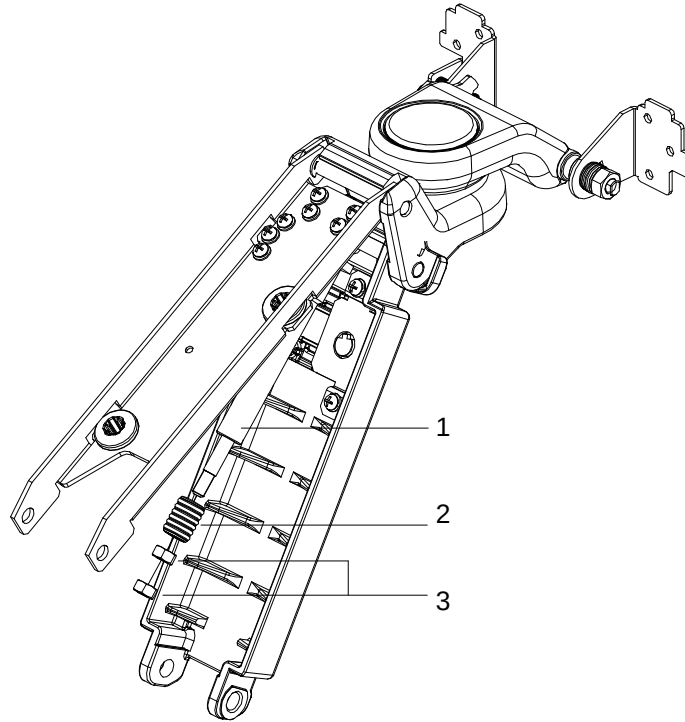
1. Make sure the upper support arm is turned upward to the extreme position before pushing the cross-pin out.
2. Hold the upper support arm when removing the cross-pin in case the upper support arm falls off. Hold the upper support arm tightly because it will be ejected out by the spring.

- 7) Extract the upper support arm along the pilot sleeve and extract the spring from the pilot sleeve.



1. Pilot sleeve of the spring
2. Spring

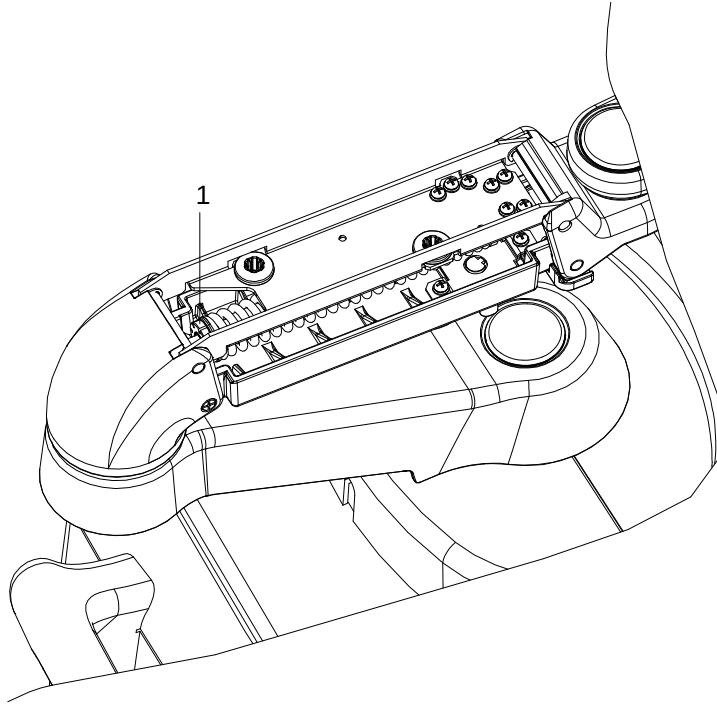
- 8) Remove the retaining nuts of the rubber damping pole and then remove the rubber damping pole from the end of the pilot sleeve.



1. Pilot sleeve of the spring
2. Rubber damping pole
3. Retaining nuts of the rubber damping pole

Tips:

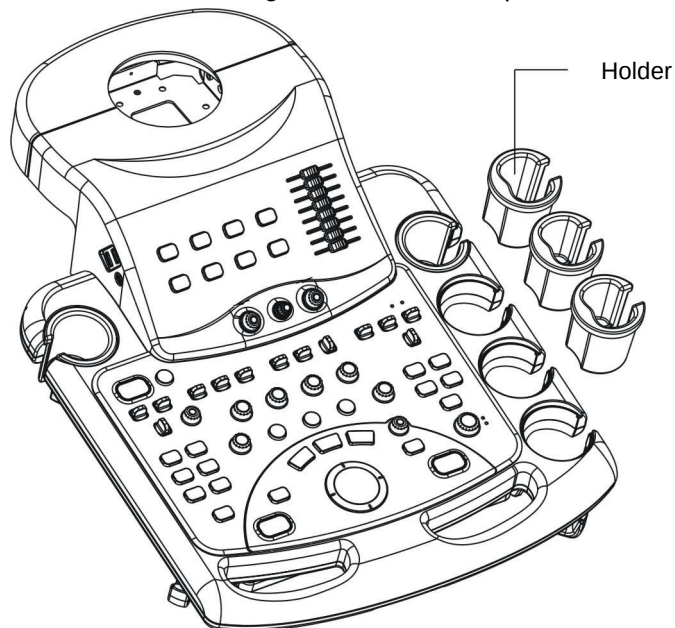
After assembling the support arm (including the monitor), check whether the monitor stays still at a random height. If not, adjust the tightness of the spring by screwing the adjusting nut with a screwdriver until the monitor stays still at a random height and then fix the upper support cover.



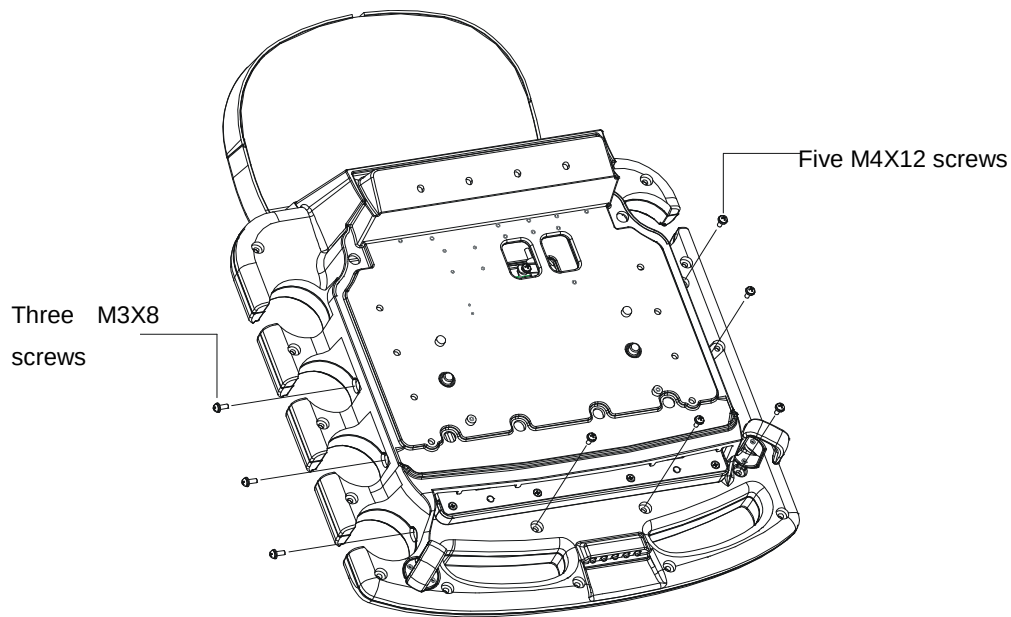
1. Adjusting nut of the spring

4.3.4 Disassembly of the main panel

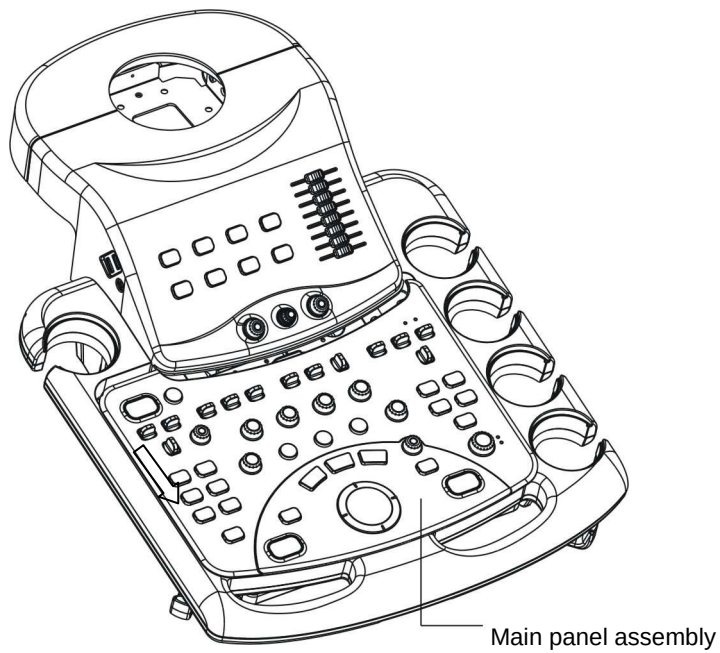
- a) Remove the three holders on the right side of the main panel.



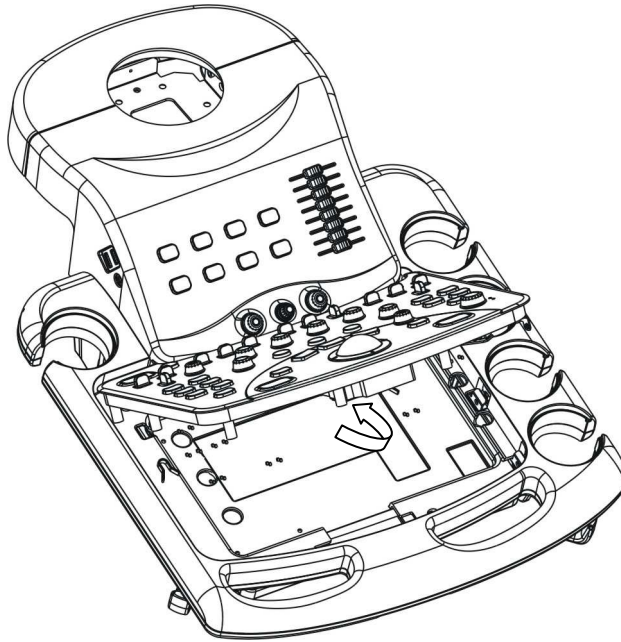
- b) Remove three M3x8 screws on the side of the main panel assembly and five M4x12 screws at the bottom (The figure below doesn't show the main unit but shows the positions of the screws.)



- c) Draw out the handle of the main panel.

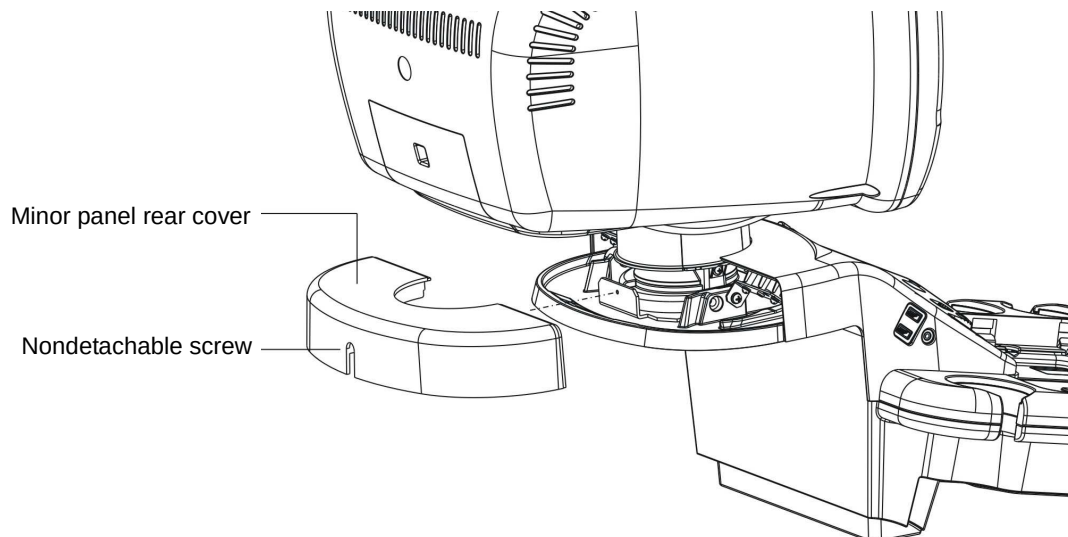


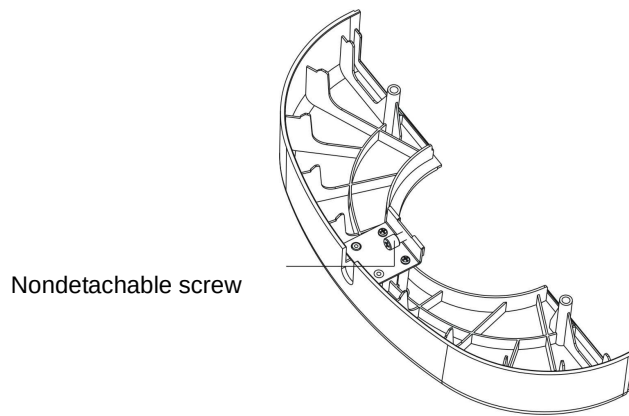
- d) Lift the front end of the main panel, and disconnect the cables, and take out the main panel.



4.3.5 Disassembly of the minor panel

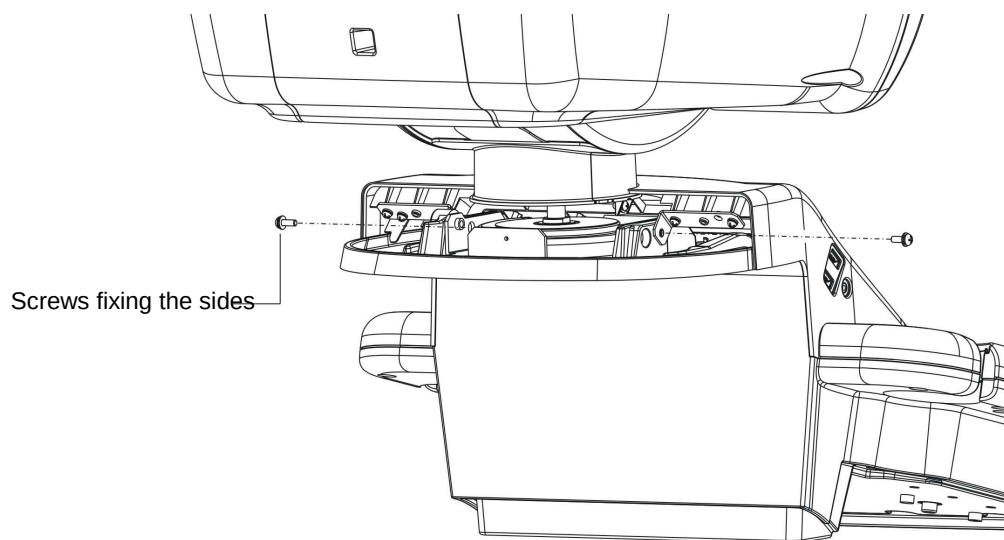
- a) Remove the main panel assembly as per the procedures described in section 4.3.4.
- b) Loosen the “nondetachable screw”, and remove the minor panel rear cover assembly.



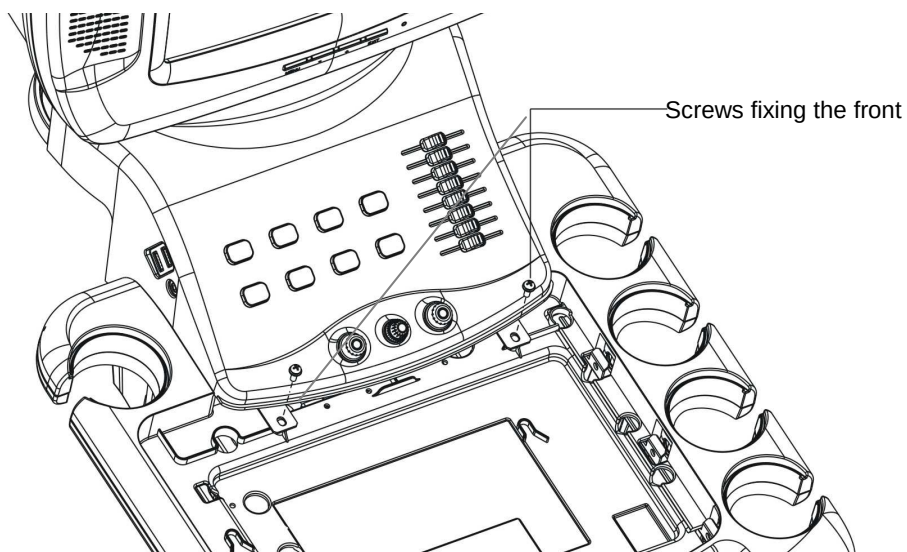


The upper arm shall be rotated to the position as shown in the figure, before the operations above are performed; otherwise, the upper arm will interfere with the disassembly of the rear cover.

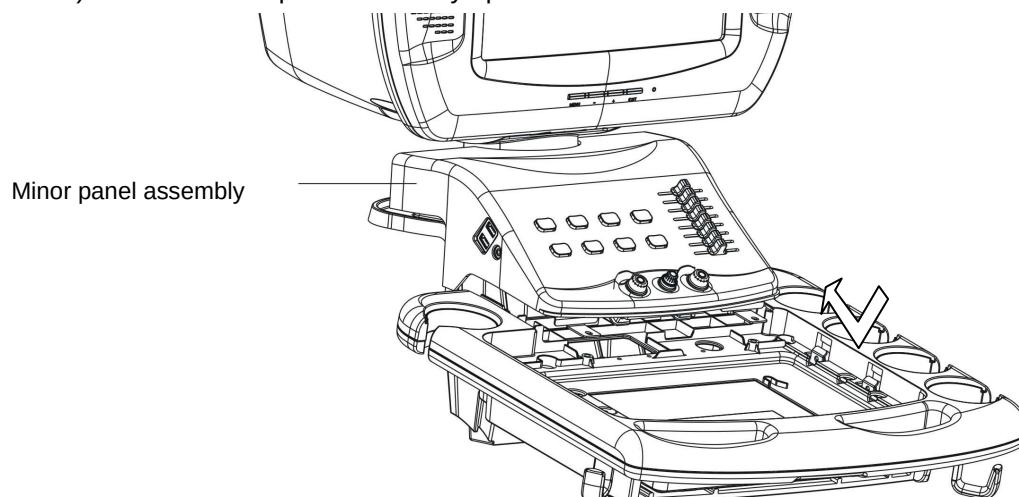
- c) Remove the two M4x8 screws fixing the sides of the minor panel assembly.



- d) Remove the two M4x8 screws fixing the front of the minor panel assembly.

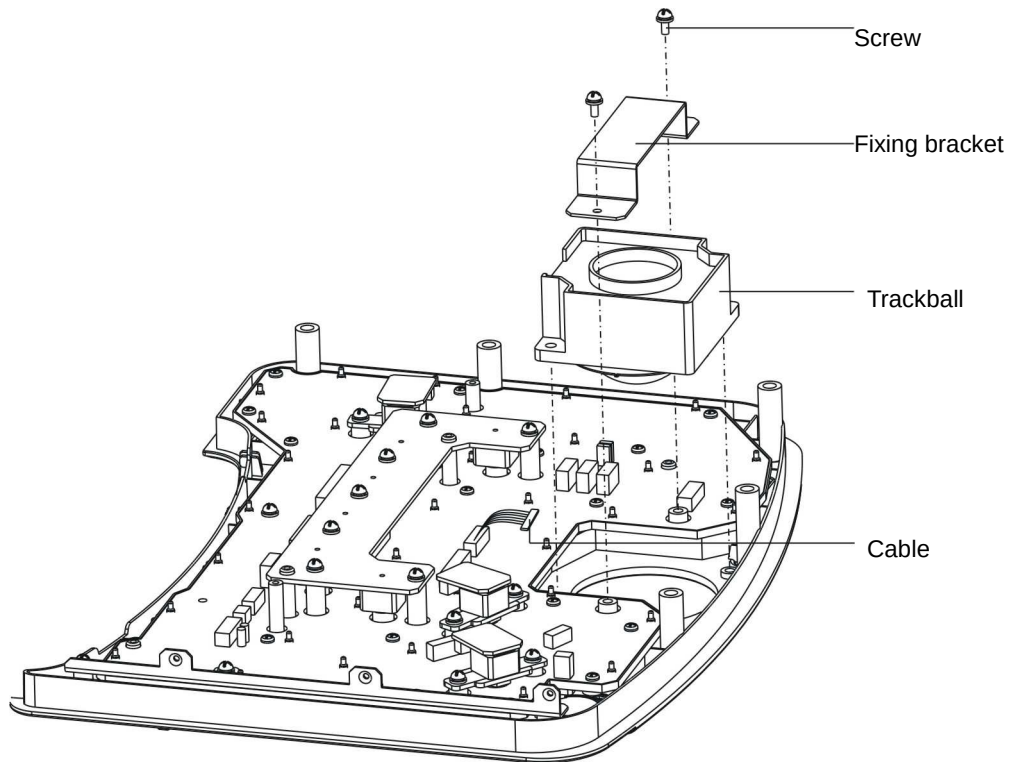


- e) Lift the minor panel assembly upward and take it out.



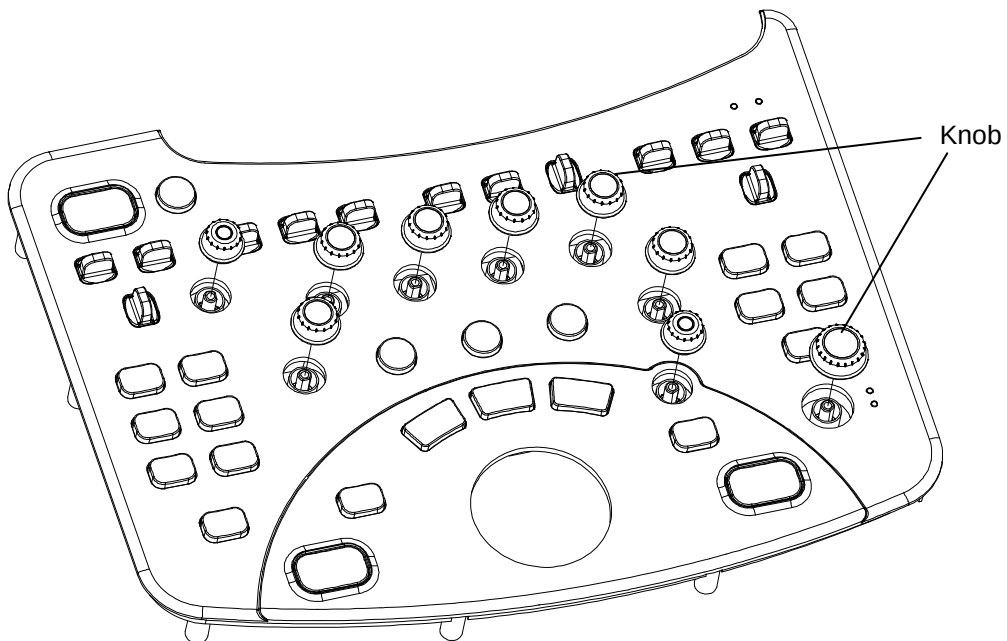
4.3.6 Replacement of the trackball

- a) Remove the main panel assembly as per the section 4.3.4.
- b) Disconnect the cable of the trackball, remove the fixing screws to take out the fixing bracket, than remove the trackball and replace it with a new one.

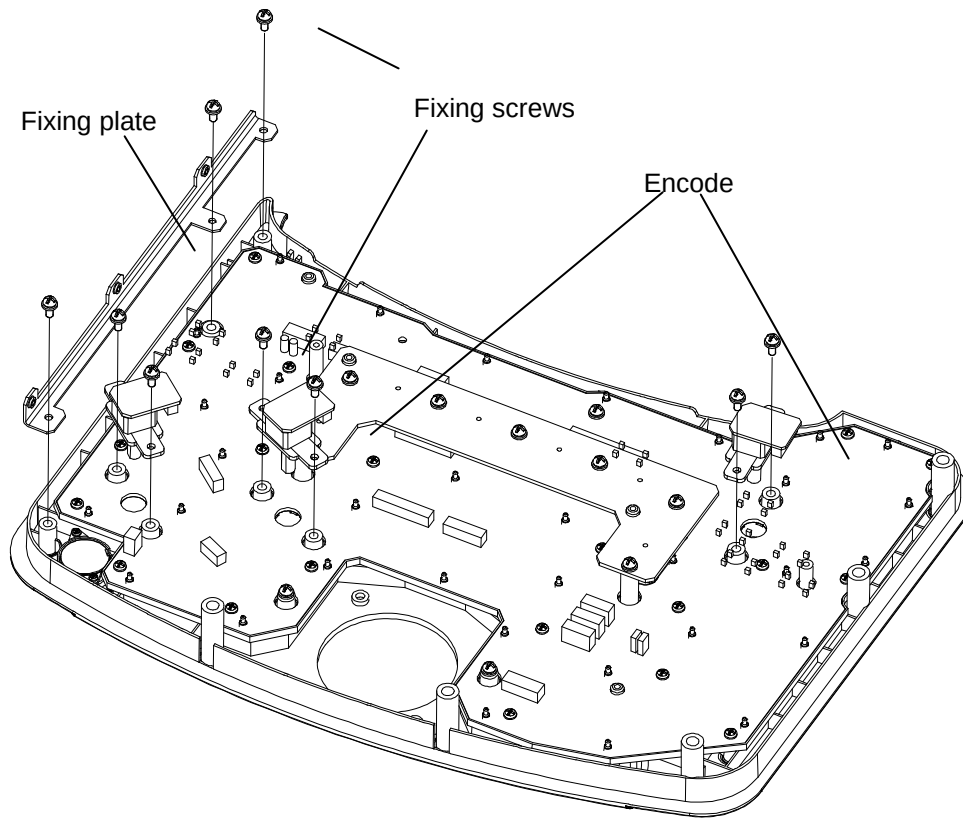


4.3.7 Replacement of the main panel PCBA

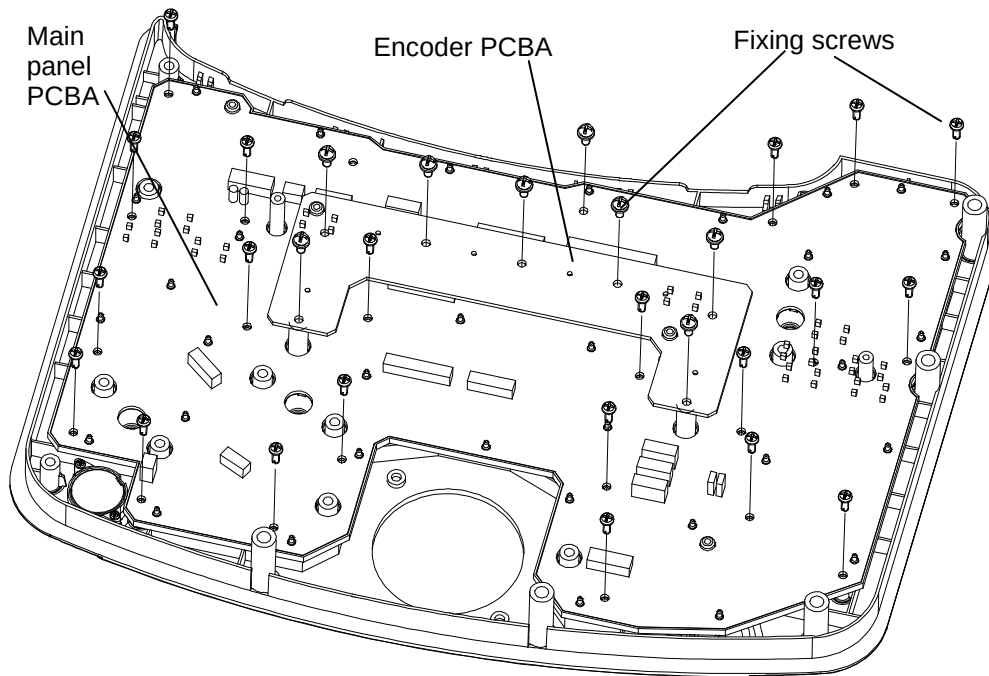
- (1) After the step 4.3.6 is completed and the trackball is removed, pull out the knobs from the panel by hand.



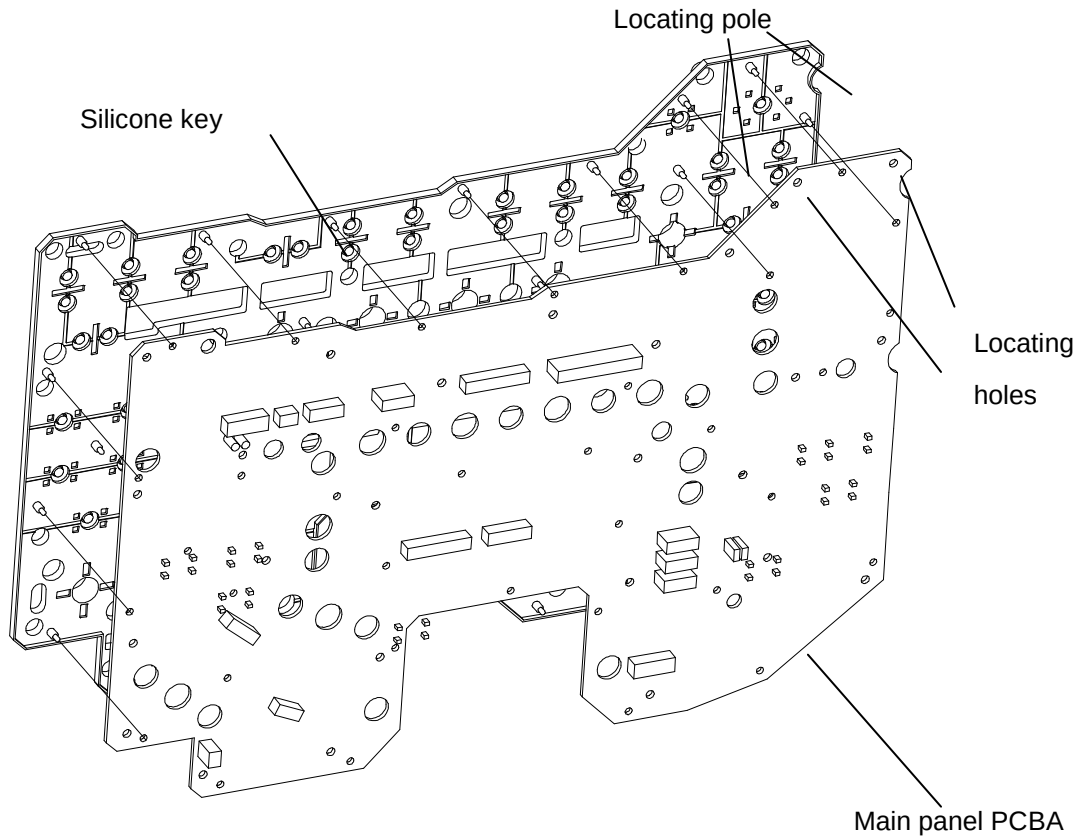
- (2) Turn over the main panel assembly, loosen the fixing plate and fixing screws of encoders, and remove the fixing plate and encoders.



- (3) Loosen the fixing screws of the encoder PCBA and main panel PCBA, and remove the encoder PCBA and main panel PCBA, and replace it with a new one.

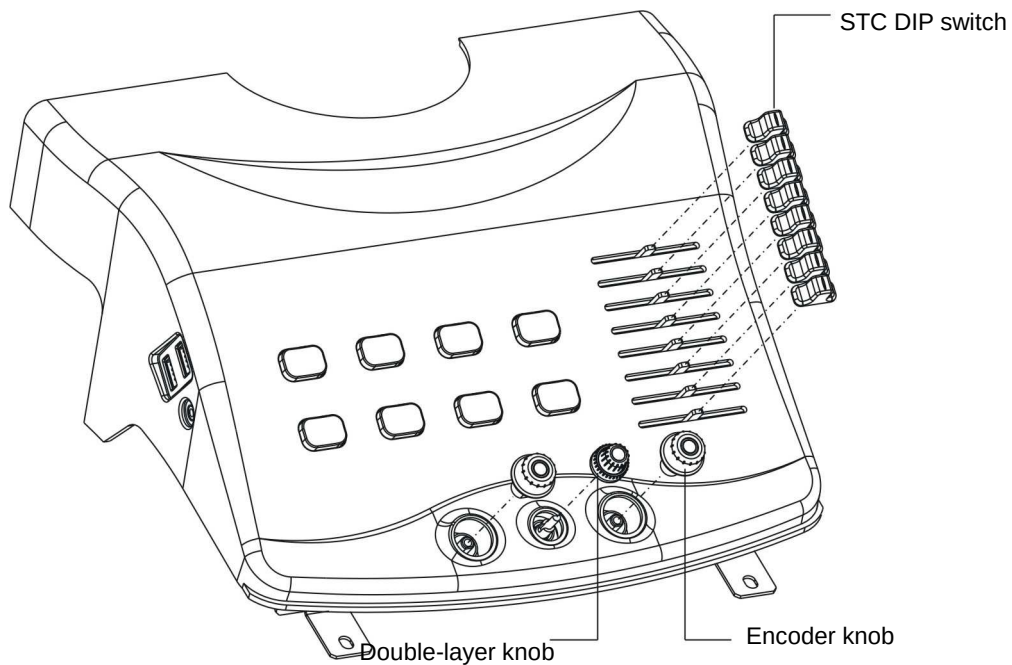


- (4) Remove silicone keys from the main panel PCBA:
- The silicone keys are installed in the main panel PCBA through the locating poles of the keys and the corresponding locating holes in the panel PCB, and they can be pulled up from the panel by hand.
 - When the locating poles are pulled up for installation of a new panel, note that each locating poles shall be pulled properly.

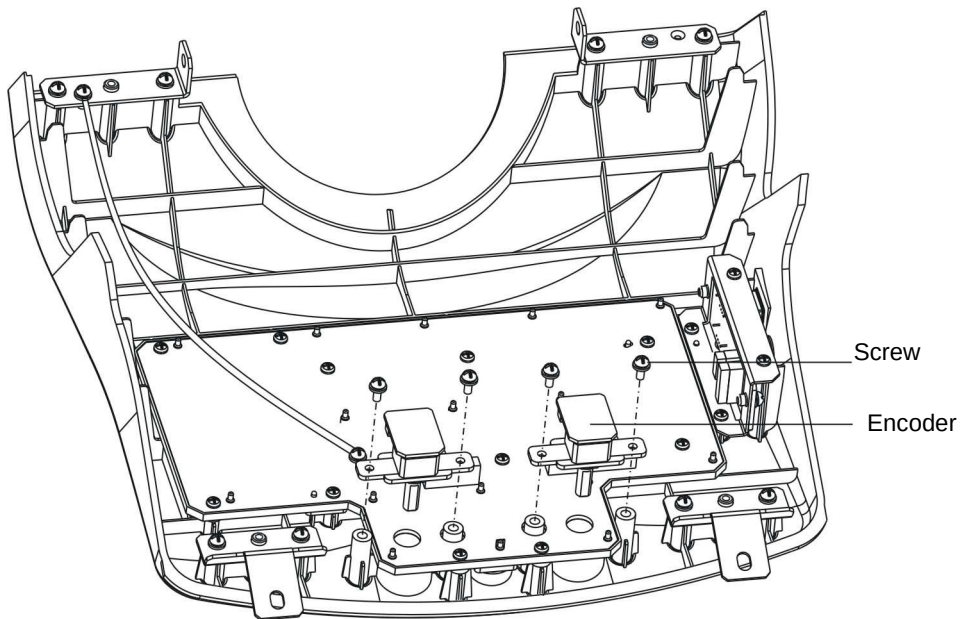


4.3.8 Replacement of the keyboard PCBA

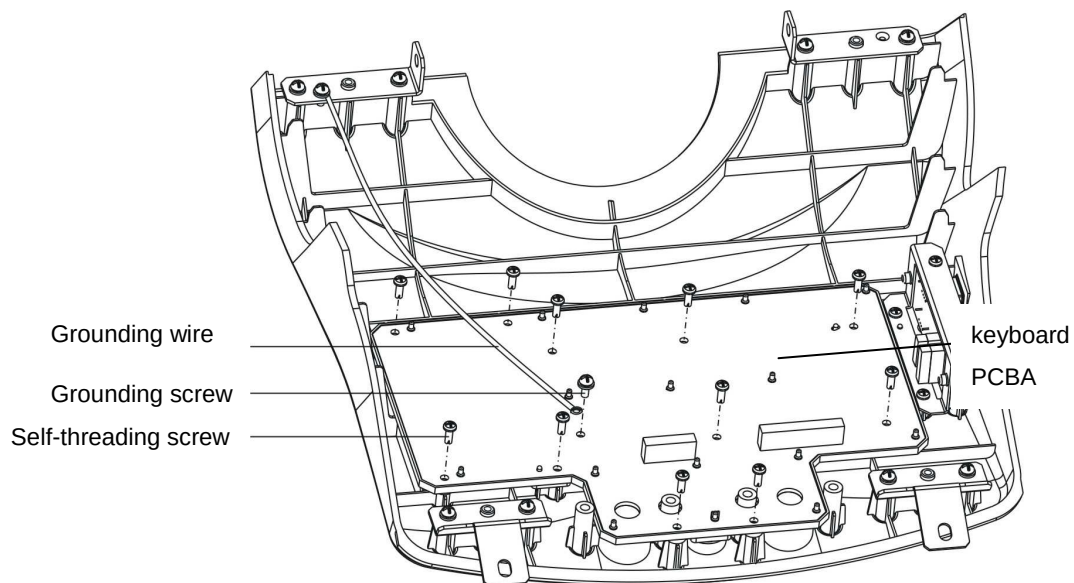
- Remove the keyboard assembly as per the section 4.3.5.
- Pull out eight STC DIP switches, two encoder knobs and one double-layer knob.



- c) Remove the four screws, pull out encoder cable and take out the encoders.



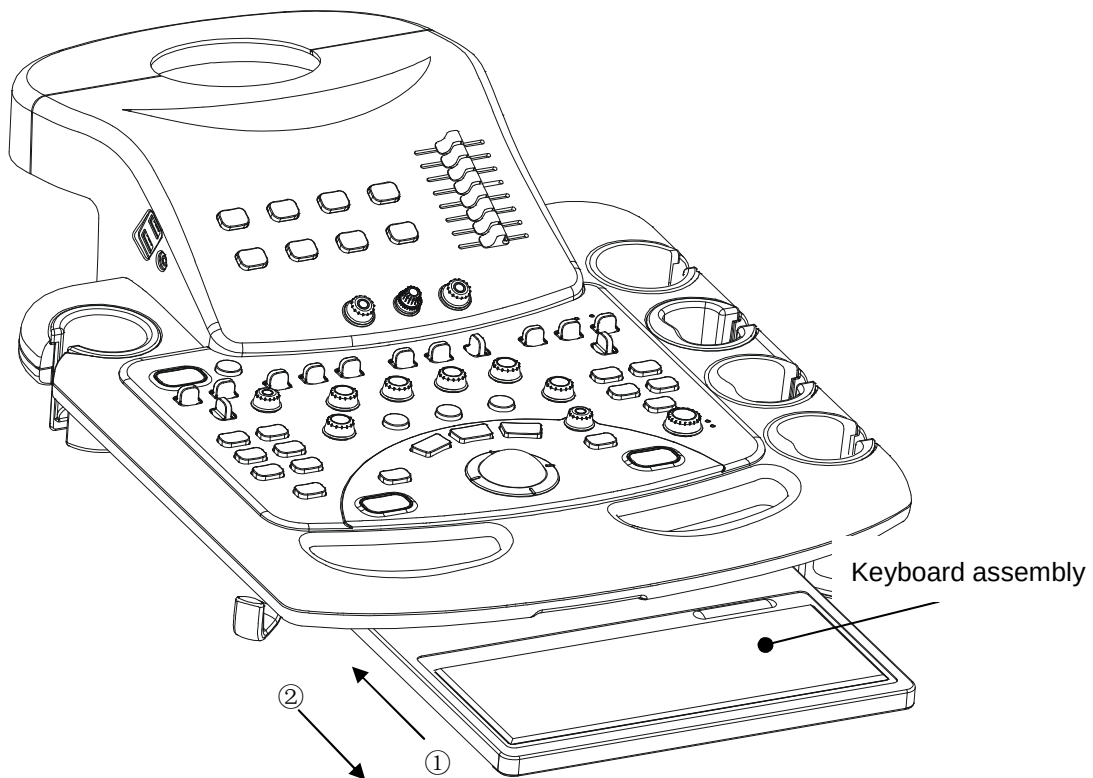
- d) Remove the self-threading screws and grounding screw, remove the grounding wire, and take out the keyboard PCBA for replacement.



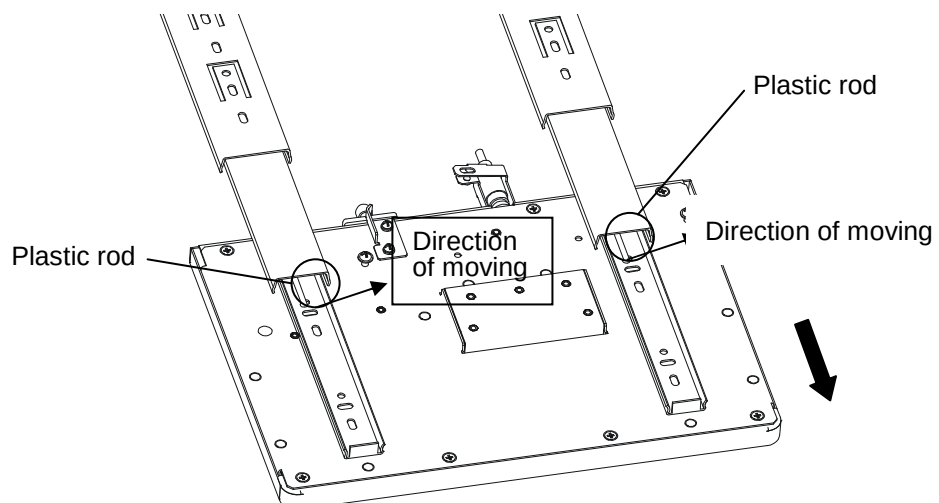
4.3.9 Replacement of the keyboard

Ejection and retraction of the keyboard assembly are both performed through pushing it inward.

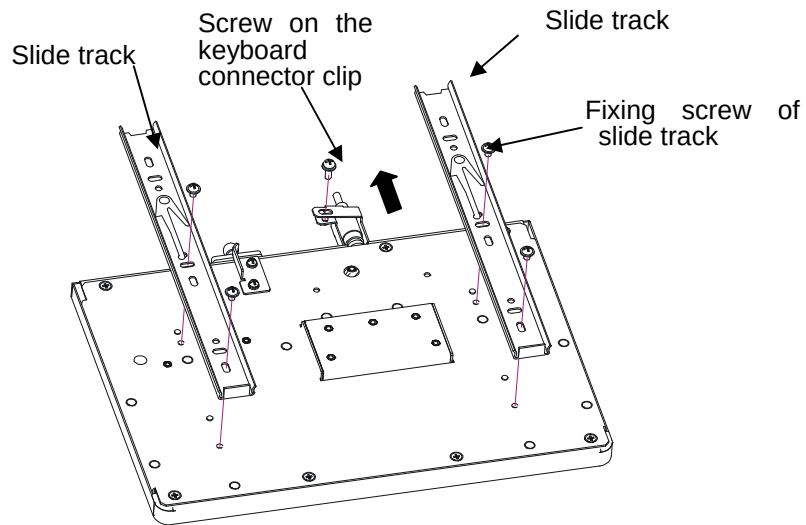
- a) Push the keyboard assembly inward (as shown by ① arrow in the figure below), and then the keyboard will eject outward (as shown by ② arrow in the figure).



b) After the keyboard assembly ejects in position, as shown in the figure (seen from the back surface), use two hands simultaneously to toggle the two plastic rods at the first nodes of the slide tracks on the back surface of the keyboard assembly (squat down if necessary), and slightly pull out the keyboard assembly; draw out the keyboard with the first nodes of the sliding tracks.



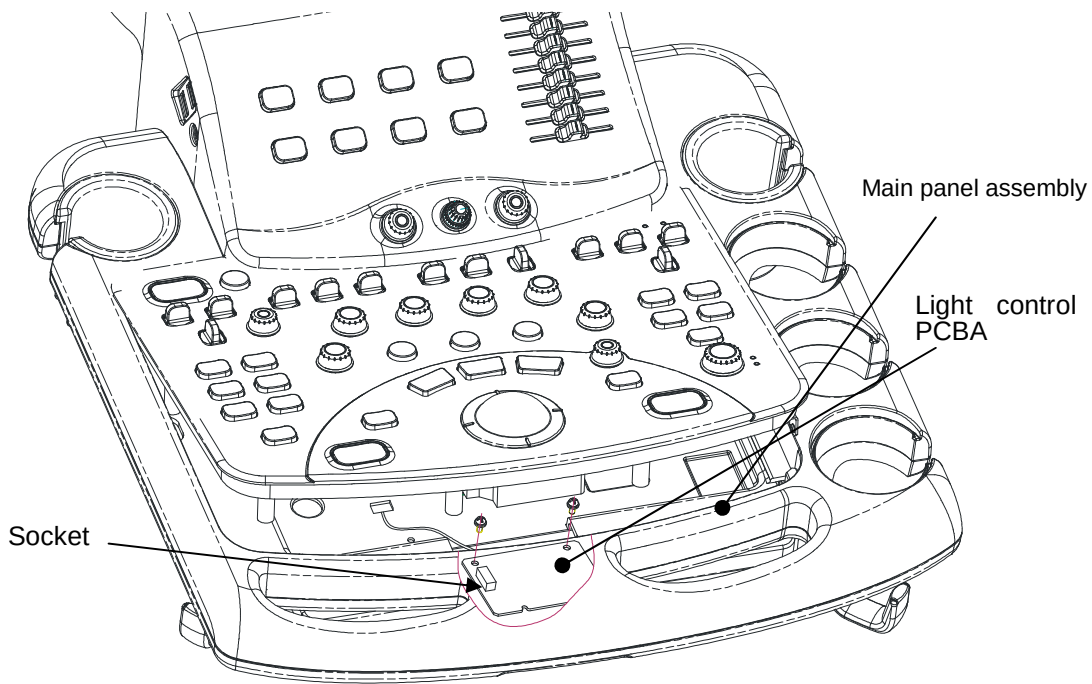
- c) Loosen the screw (M4X12) on the keyboard connector clip, and remove the cable joint of the keyboard to take out the keyboard.



- d) Remove the fixing screws (4 M4X8 panhead screws with washers) of remaining slide tracks and keyboard support, and install the slide tracks to the new keyboard assembly.
- e) Insert the connector of the keyboard cable to the new keyboard assembly, and tighten the screw on the keyboard connector clip.
- f) Hold the keyboard by hands, align the tracks, push the keyboard evenly to the end, and repeatedly push and pull to check if the keyboard is properly installed.

4.3.10 Replacement of the light control PCBA

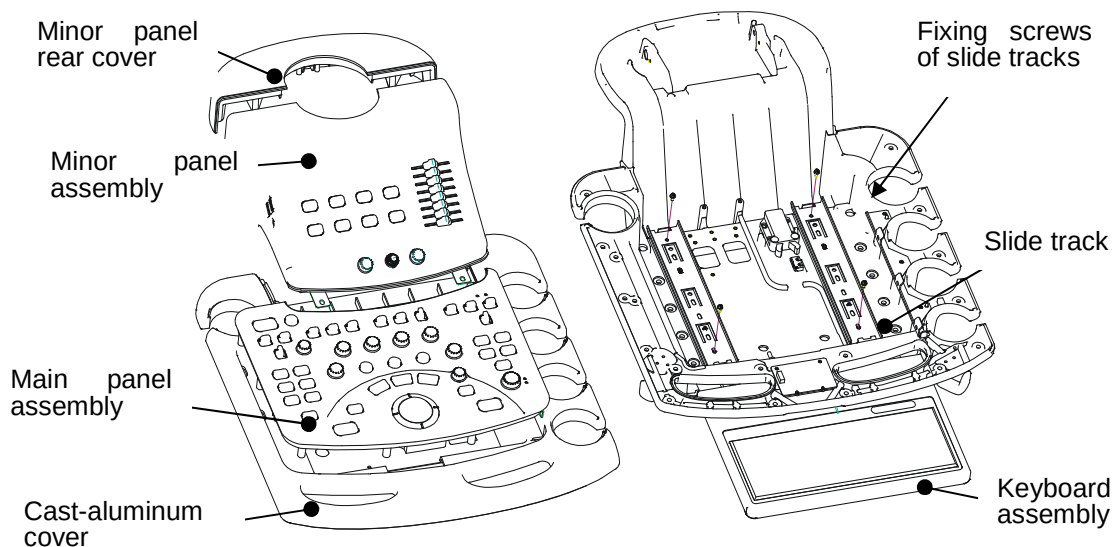
- a) Remove the fixing screws of the main panel assembly (see 4.3.4), lift the front of the main panel assembly, and remove the socket of the light control PCBA on the main panel assembly.



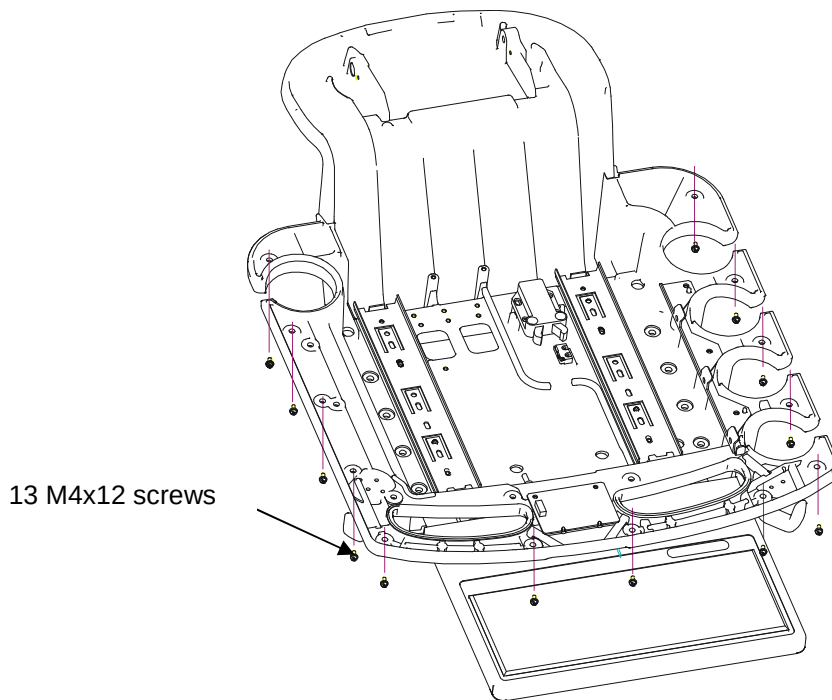
b) Use a screwdriver to remove two screws fixing the light control PCBA (2 M4X8 screws), remove the light control PCBA and replace it with a new one, and install the new PCBA. (Note the light shall face right to the hole on the cast-aluminum panel).

4.3.11 Replacement of the keyboard slide tracks

a) Remove the main panel assembly and minor panel assembly (see section 4.2.3 and section 4.2.4), and disconnect the cables, as shown in the figure below.



b) Remove 13 M4x12 screws fixing the cast-aluminum cover, and remove the cast-aluminum, as shown in the figure below.



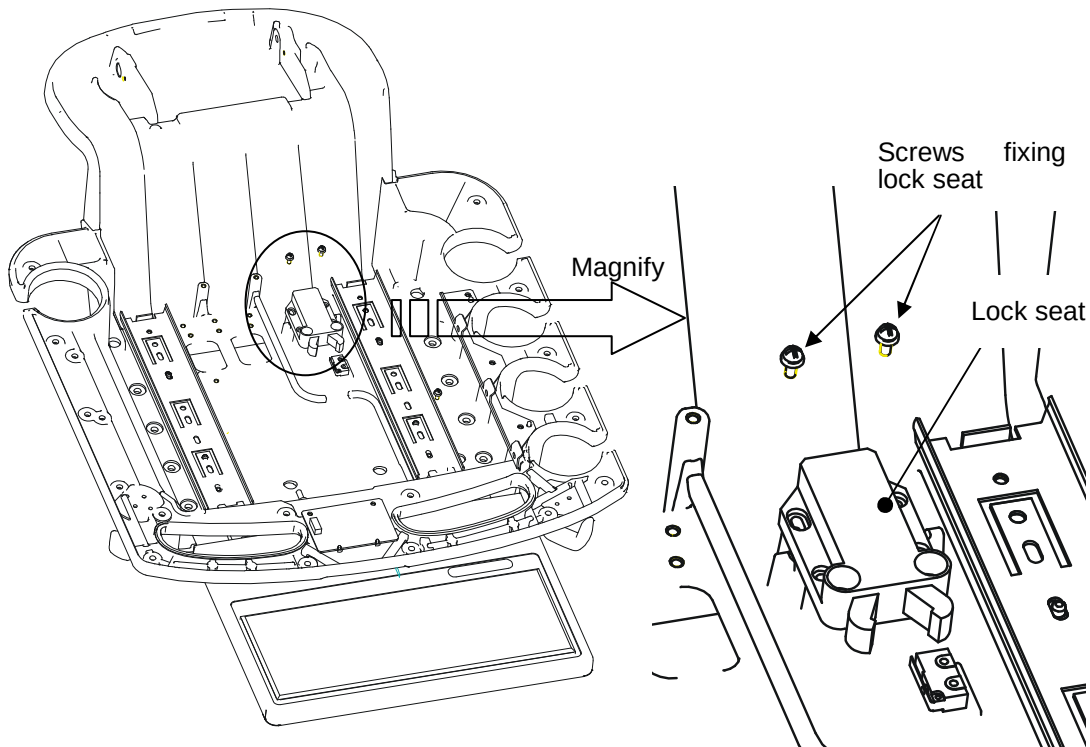
- c) After the keyboard ejects completely, remove the four screws fixing the slide tracks (4 M3X8 screws) to take out the keyboard assembly and slide tracks.
- d) Disassemble the slide tracks from the keyboard assembly, replace them with new tracks and install on the keyboard assembly.
- e) Align the new tracks with the locating poles on the cast-aluminum panel, place the four screws loosened on the tracks, repeatedly push the keyboard assembly to confirm that the keyboard can smoothly move and eject in position, and tighten the four screws.
- f) According to the reversed order, install the cast-aluminum cover, minor panel assembly, main panel assembly and minor panel rear cover.

4.3.12 Replacement of the snap-close (lock head and lock seat)

4.3.12.1 Replacement of the lock seat

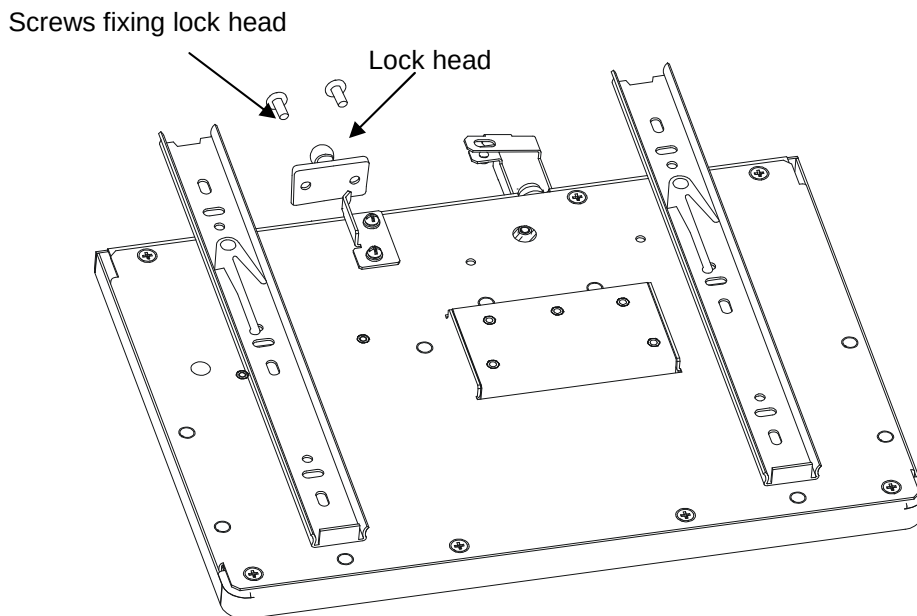
- a) As per section 4.3.4 and 4.3.5, remove the main panel and the minor panel, remove the screws fixing the cast-aluminum cover, and remove the cast-aluminum cover.
- b) Remove 4 screws fixing the lock seat (4 M3X10 cross panhead screws), and replace it with a new lock seat.

- c) Install the new lock seat properly.



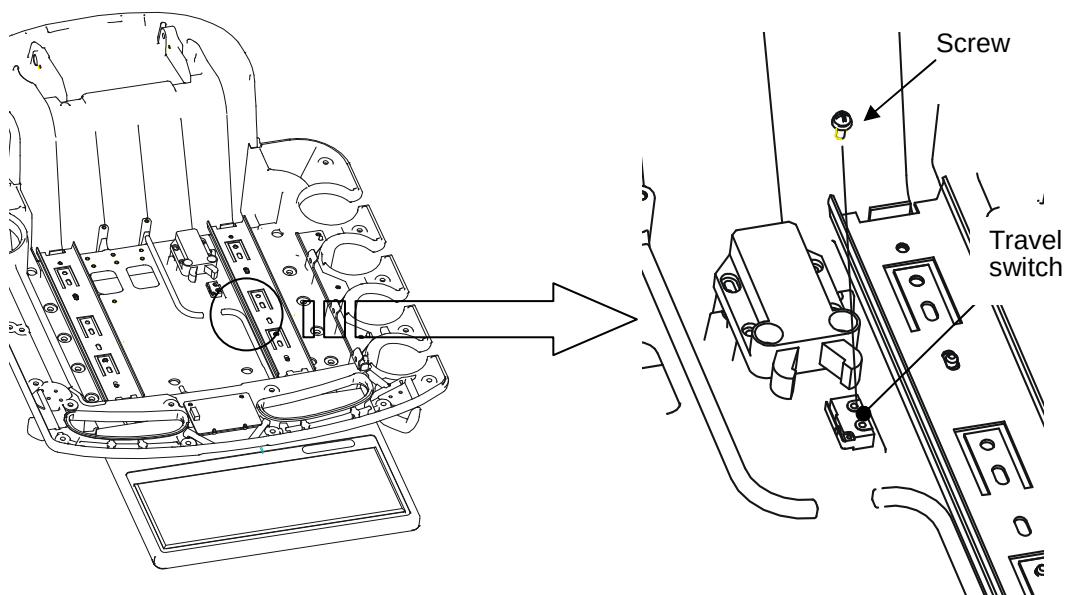
4.3.12.2 Replacement of the lock head

- The procedures are identical to section 4.3.9 a, b, and c (replacement of keyboard assembly).
- After removing the keyboard assembly, remove the screws fixing the lock head (2 M3X8 screws).
- Replace it with a new lock head, and install it again.



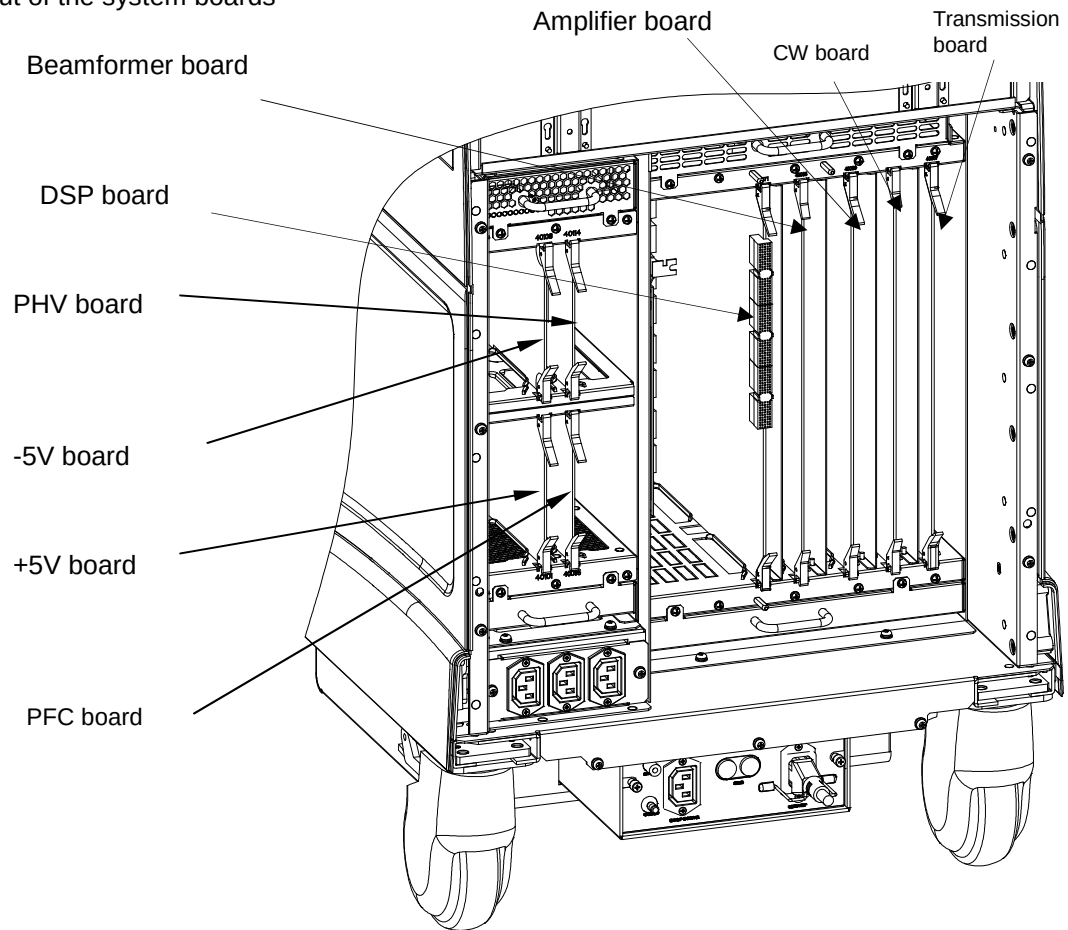
4.3.13 Replacement of the travel switch (with the cable)

- a) Remove the main panel assembly and minor panel assembly (see section 4.3.4 and section 4.3.5), and remove the fixing screws of the cast-aluminum cover to take out the cast-aluminum cover.
- b) Remove two screws (M2X10 cross panhead screw) fixing the travel switch (with cable), replace it with new cable of the travel switch, and connect the cable properly.
- c) According to the reversed order, install the travel switch properly.



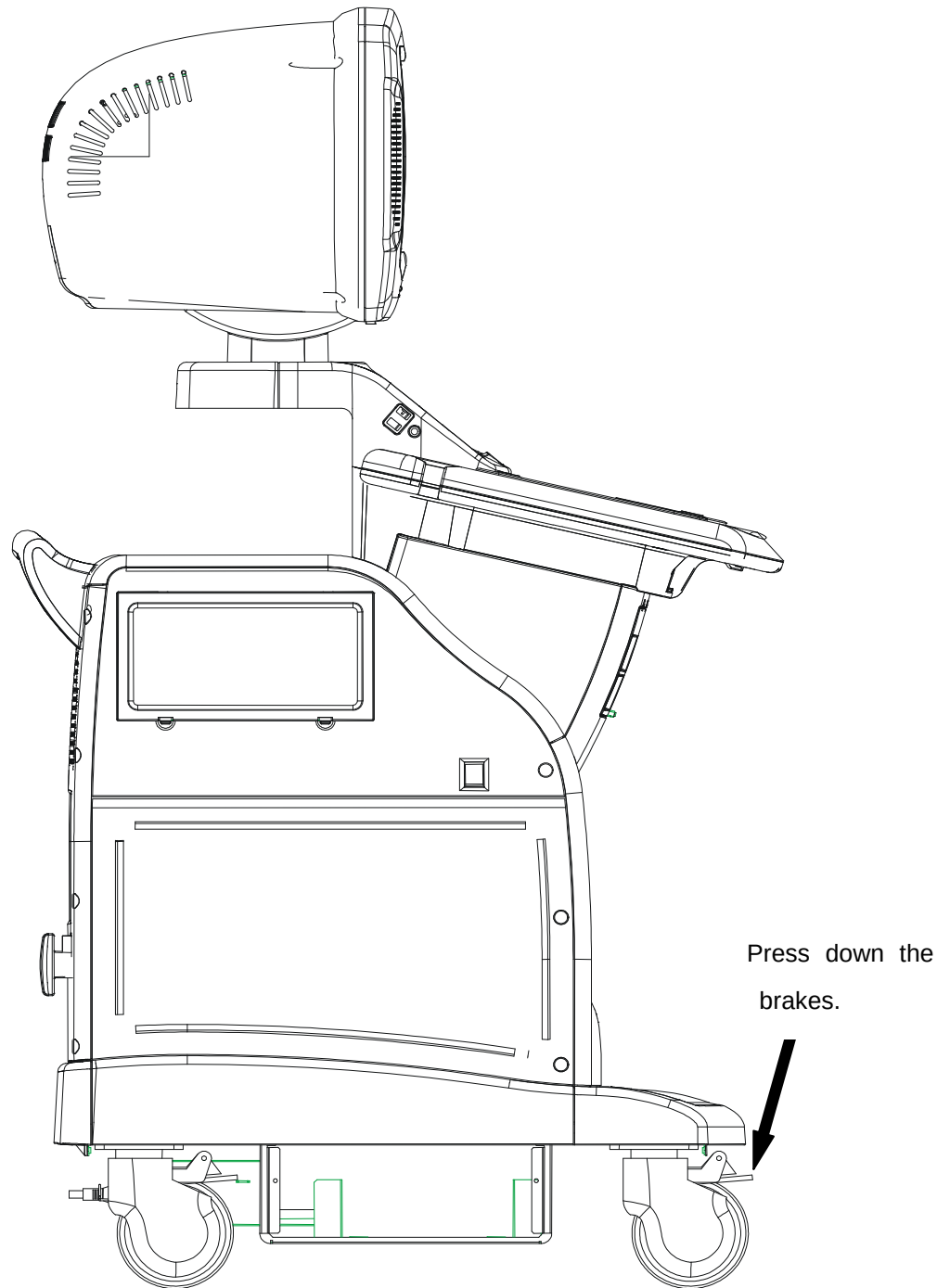
4.3.14 Disassembly of the system boards

Layout of the system boards



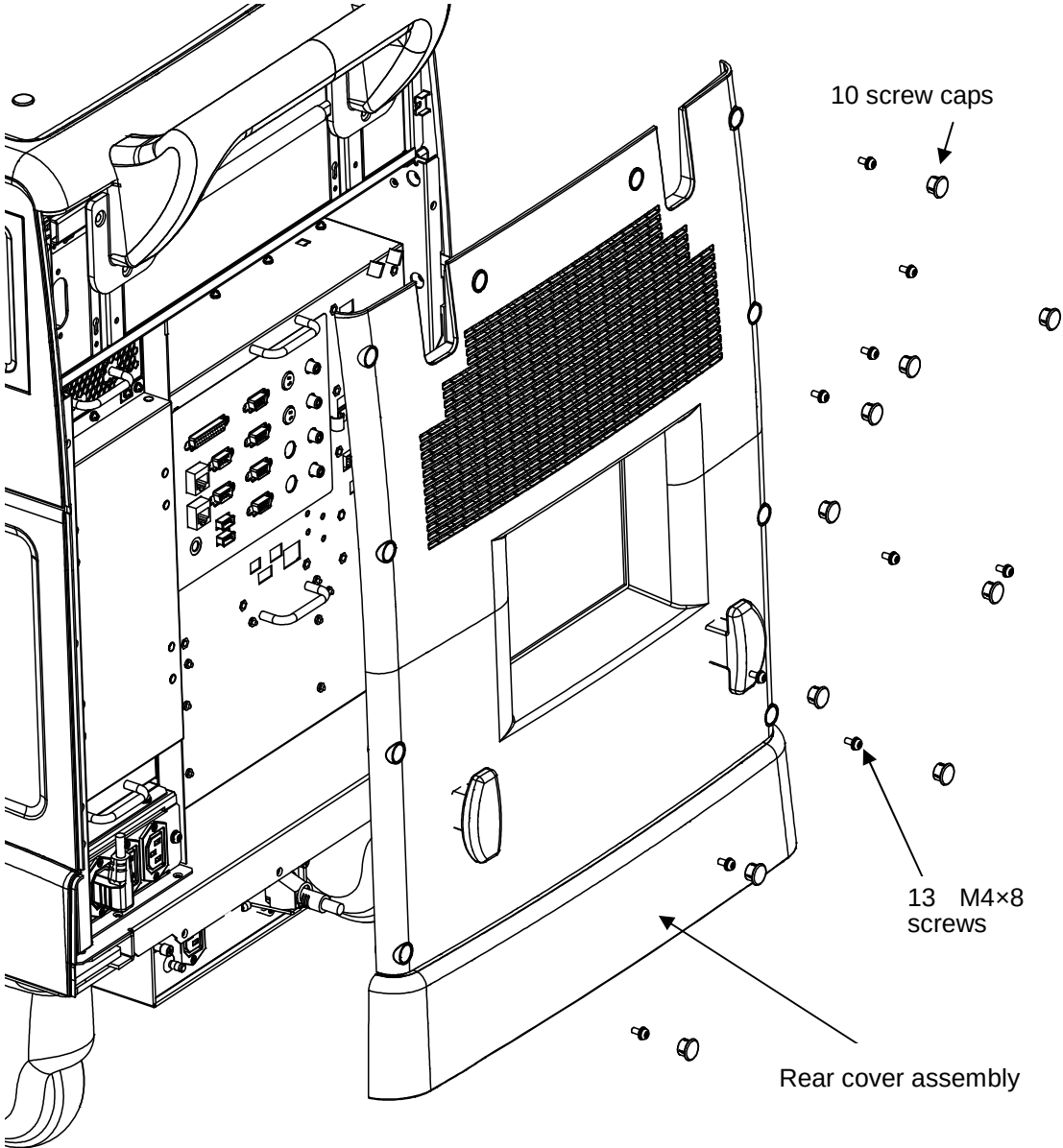
4.3.14.1 Press down the brakes of the casters

Note: Brake the system immediately when it isn't necessary to move it.



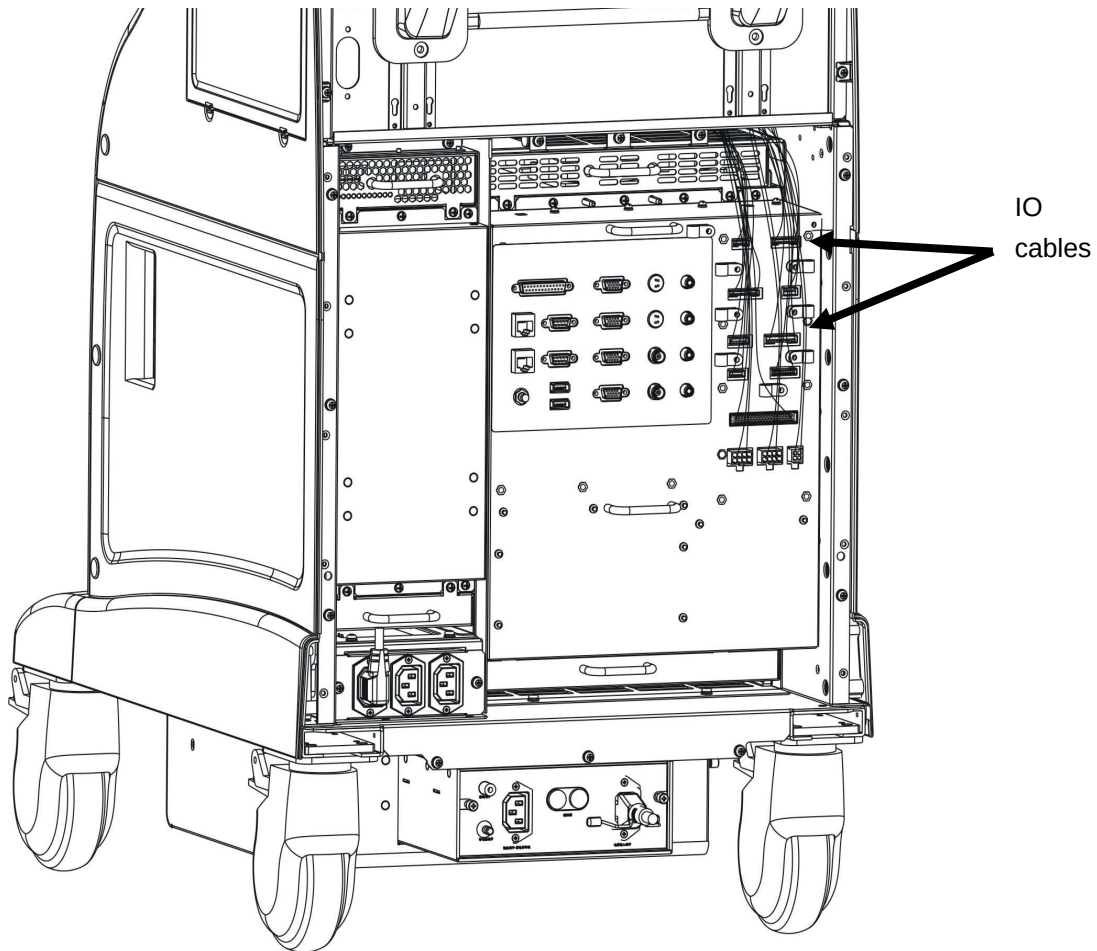
4.3.14.2 Remove the screw caps, screws and rear cover

- a) Remove 10 screw caps of the rear cover.
- b) Remove 13 M4×8 screws connecting the rear cover and the main unit housing.
- c) Push down the rear cover assembly, remove the handle of the main unit, and remove the rear cover assembly.

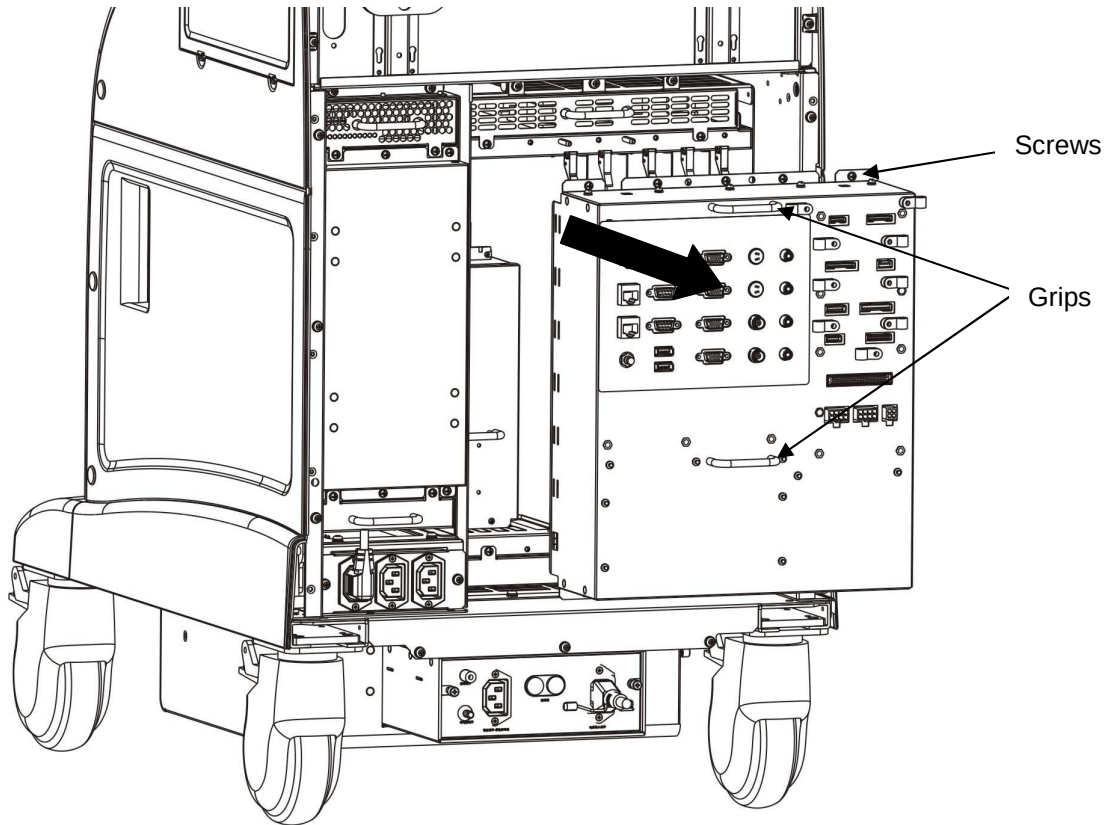


4.3.14.3 Remove IO assembly

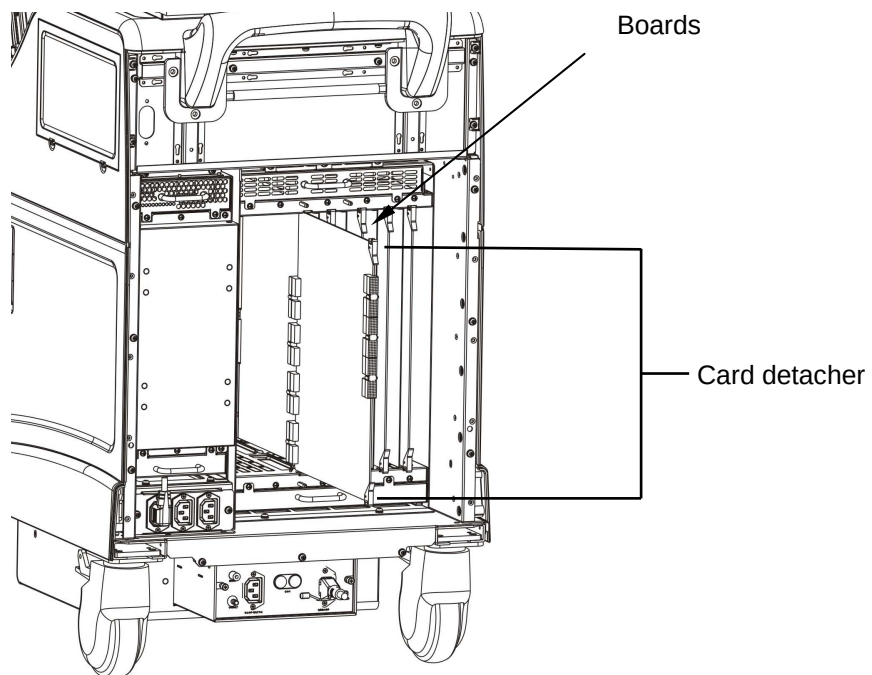
- a) Remove the cables from the IO panel, i.e., remove the connectors from the IO interfaces. Care shall be taken to avoid damage of the cables.



- b) Remove the two rows of M3x8 screws fixing the IO assembly, hold the two grips by hands, and take out the IO assembly. If a built-in PC module is installed, you shall disconnect USB and network cables between the PC module and IO assembly.

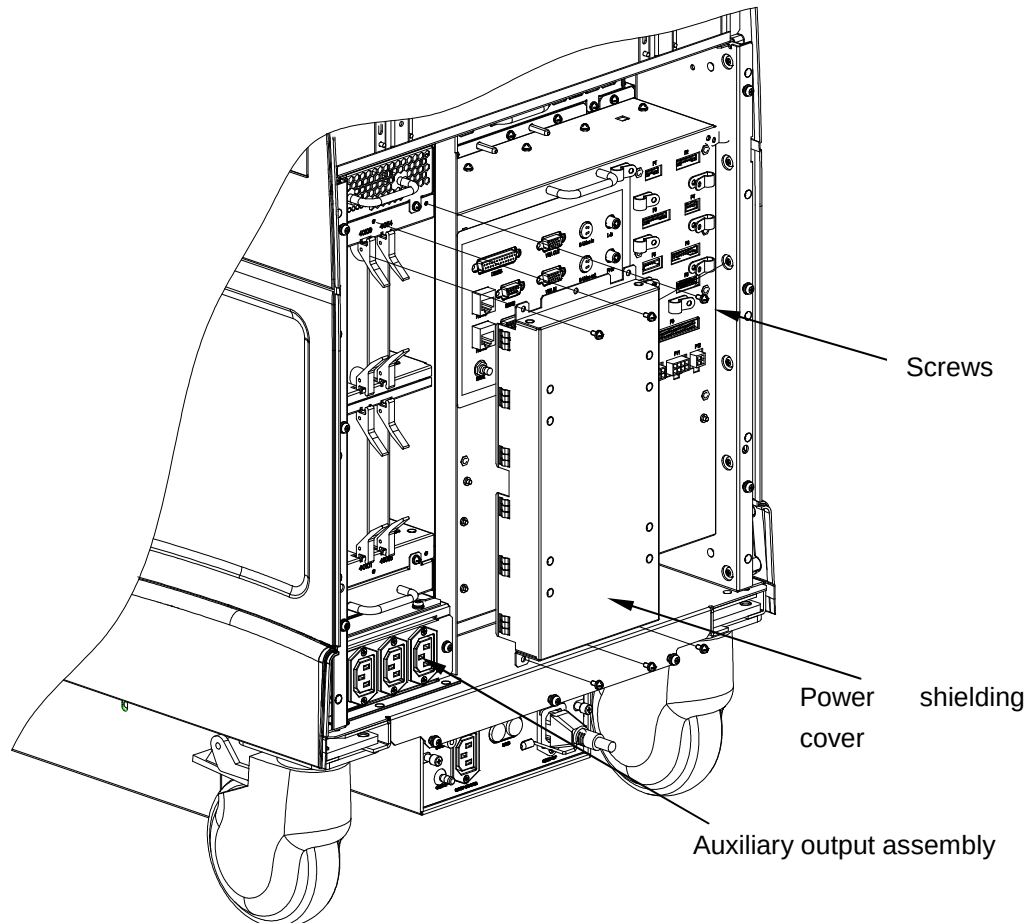


- c) Pull out the card detacher, and remove the boards one by one.

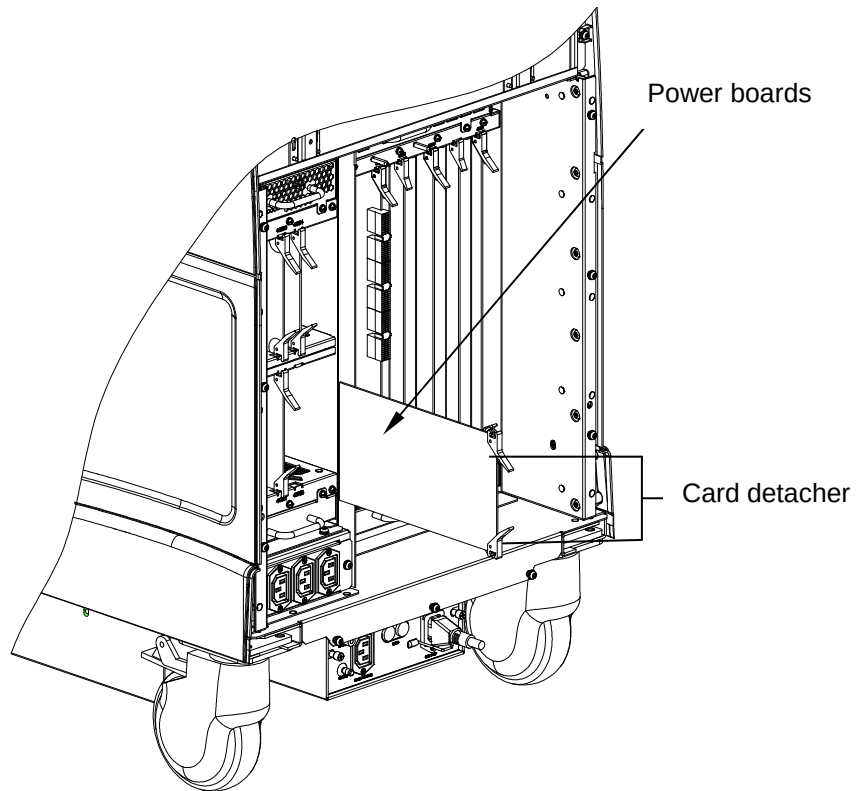


4.3.14.4 Remove the power boards

- a) To remove the auxiliary output cables and shielding cover of the power main unit box: disconnect the three power connectors of the auxiliary output assembly; Remove six M3X8 screws fixing the shielding cover of the power box.



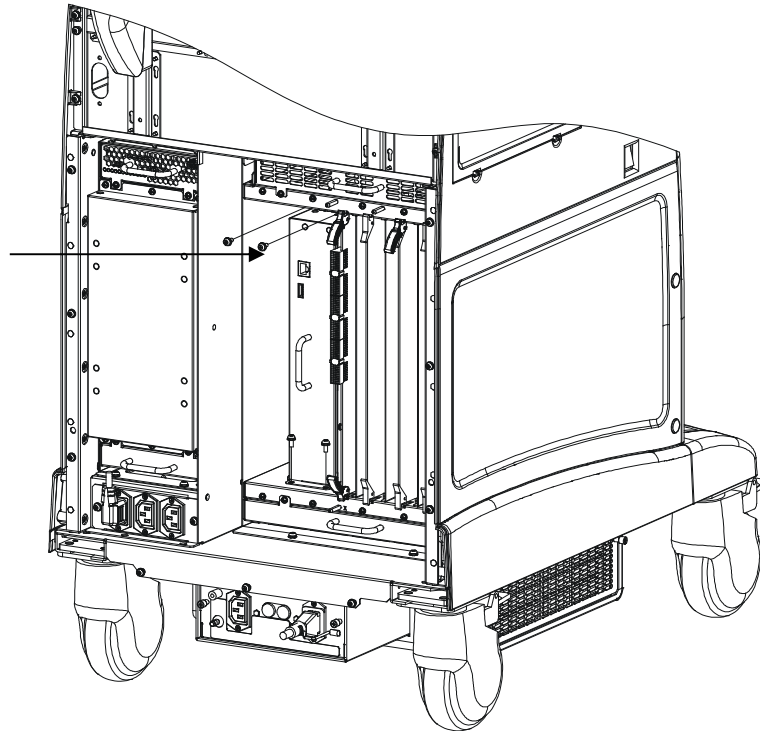
- b) Pull out the card detacher, and remove the power boards one by one.



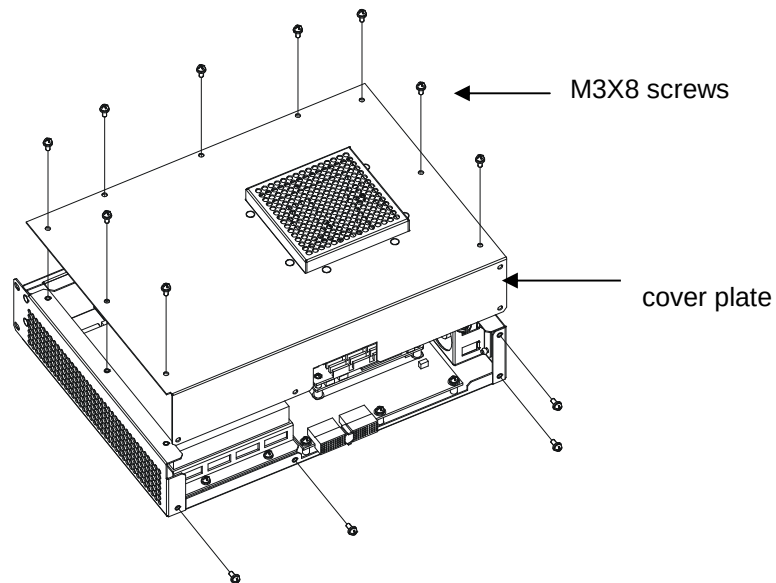
4.3.15 Remove built-in PC module

- a) Repeat section 4.3.14.1 to push down the brake to lock up the casters.
- b) Repeat section 4.3.14.2 to remove screws and rear cover.
- c) Repeat steps a and b in section 4.3.14.3 to remove wires of IO panel, and to remove IO panel; remove the network cables and USB wire of PC module and IO panel.
- d) Remove four M4x8 screws fixing built-in PC module, two screws above and two below; grasp the handle and take the PC module out.

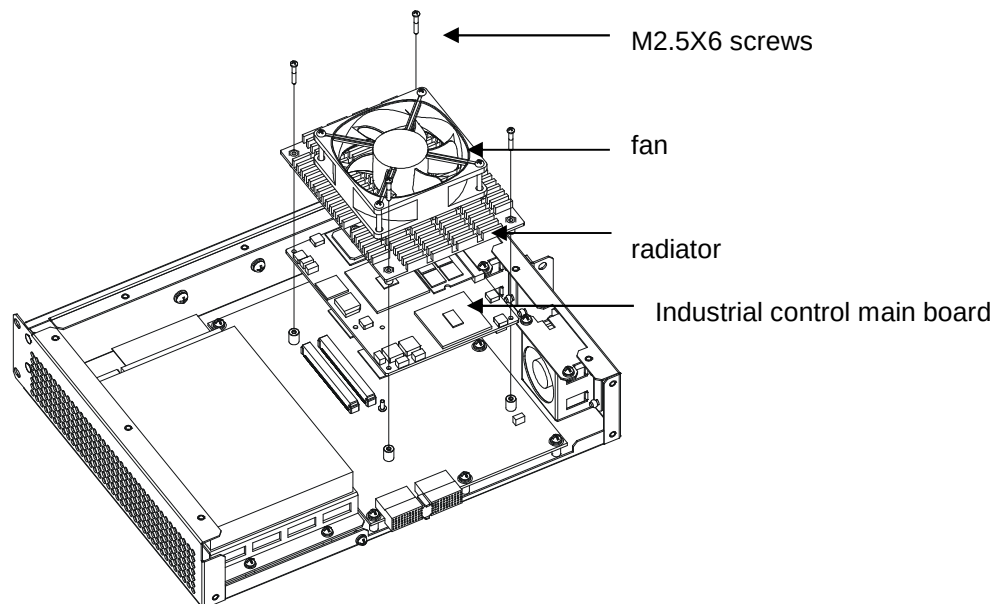
M4X8 screws



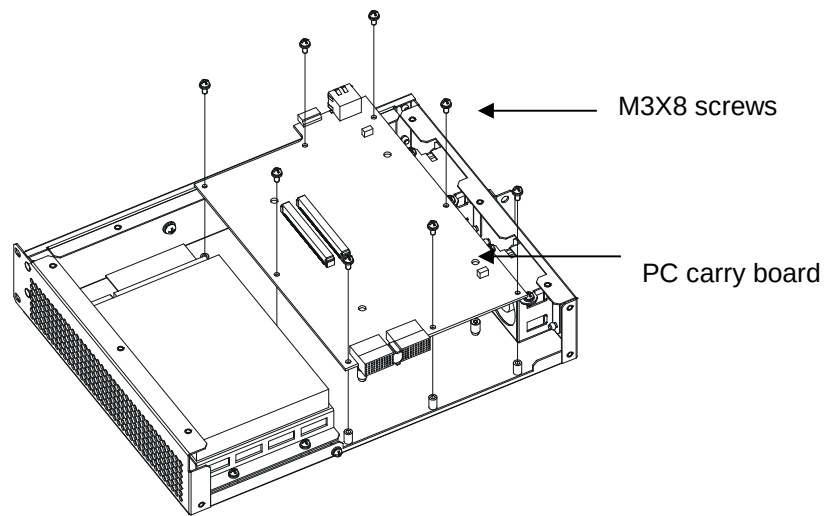
- e) Remove 13 M3X8 screws fixing cover plate and wire connectors, and remove the cover plate and bale of wire between 3D module and IO board.



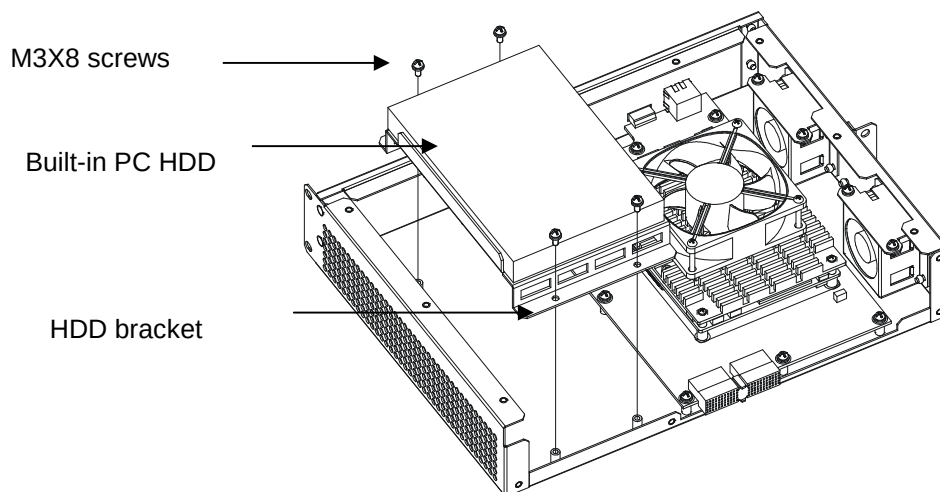
- f) Disconnect the wire connector of the fan from the PC carry board, remove the four M2.5X6 screws fixing the radiator, and then remove the industrial control main board from the PC carry board.



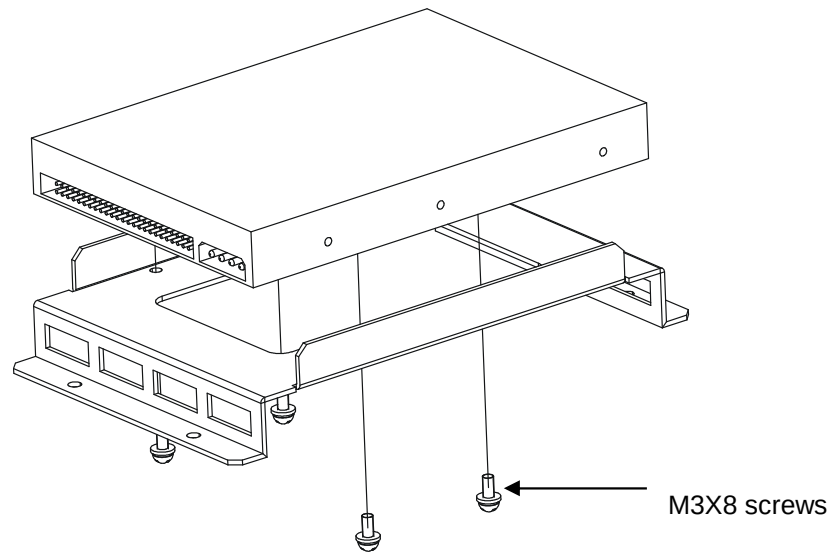
- g) Disconnect wires from the PC carry board, remove 8 M3X8 screws, and take out the PC carry board.



- i) Disconnect the wires behind HDD, remove four M3X8 screws fixing the bracket, and remove the HDD.

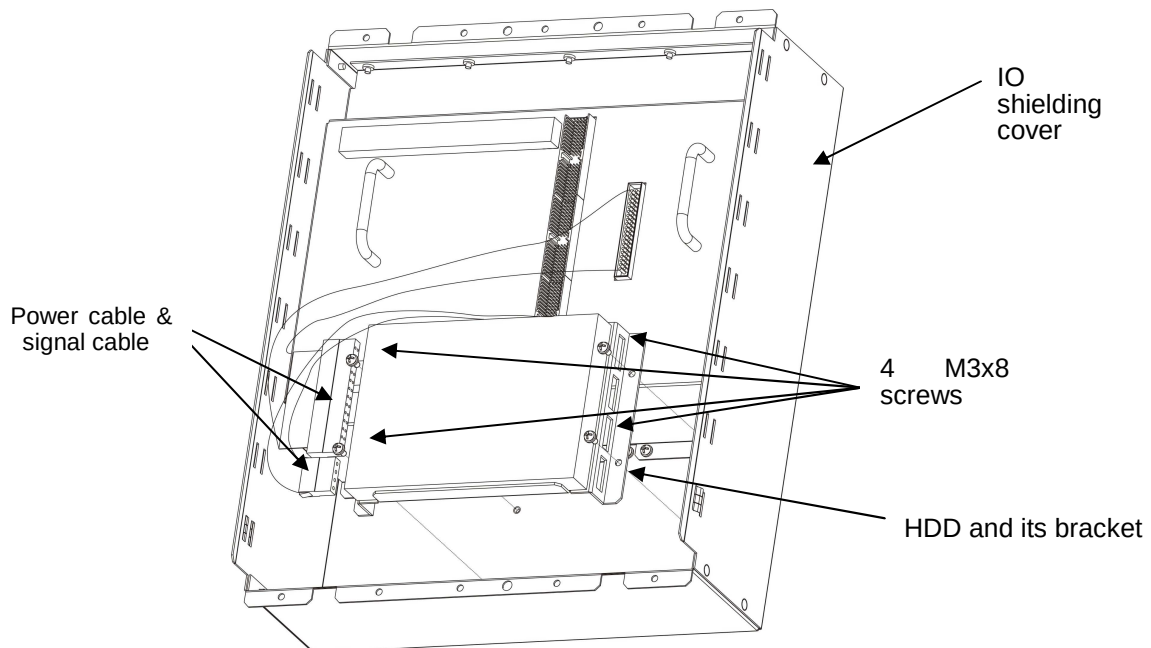


- j) Remove four M3X8 screws in the HDD bracket in order to replace HDD.

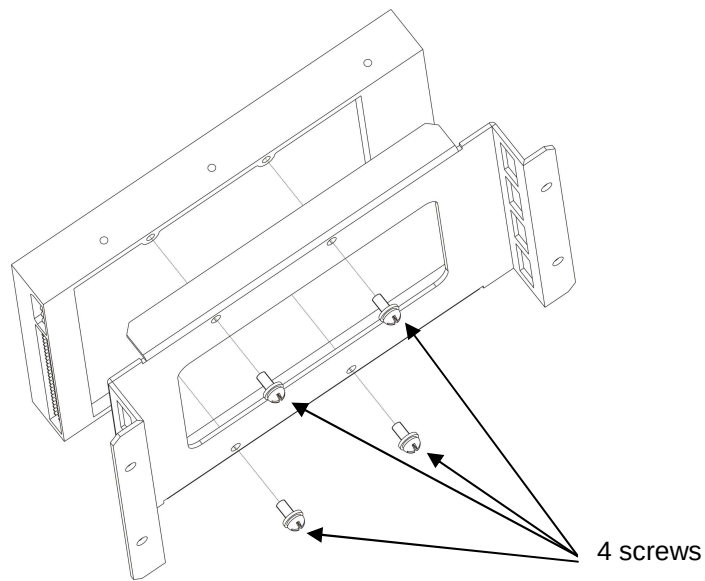


4.3.16 Remove HDD

- a) After removing the IO assembly, disconnect the HDD power cable and signal cable, then remove HDD bracket and 4 M3x8 screws fixing IO shielding cover, and remove HDD and its bracket.



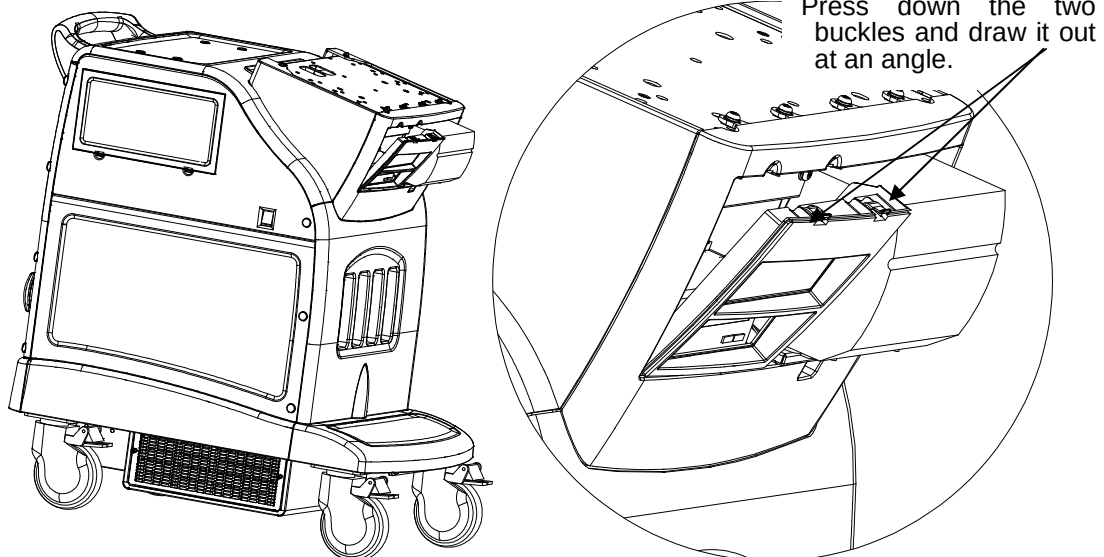
- b) Remove 4 screws fixing the HDD in its bracket to take out the HDD.



4.3.17 Remove the DVD-R/W assembly

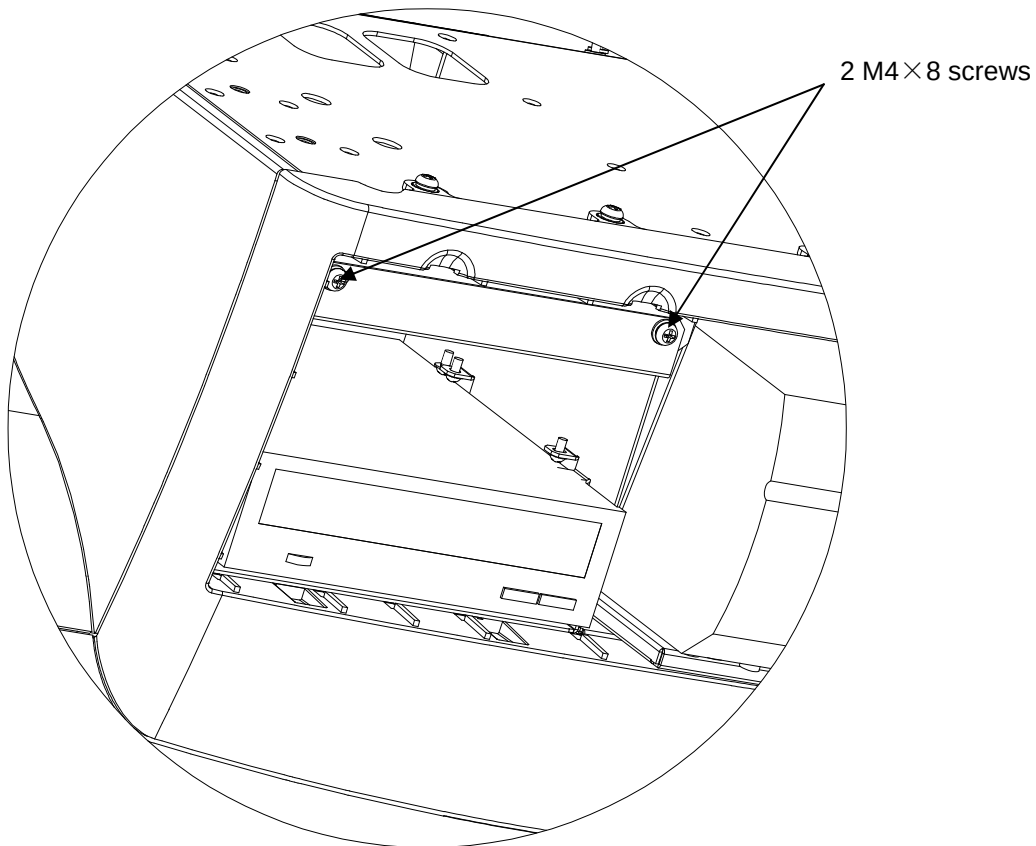
- a) Remove the DVD-R/W cover:

Press down the two buckles on the CD/RW cover, and draw it out at an angle to take out the DVD-R/W cover.

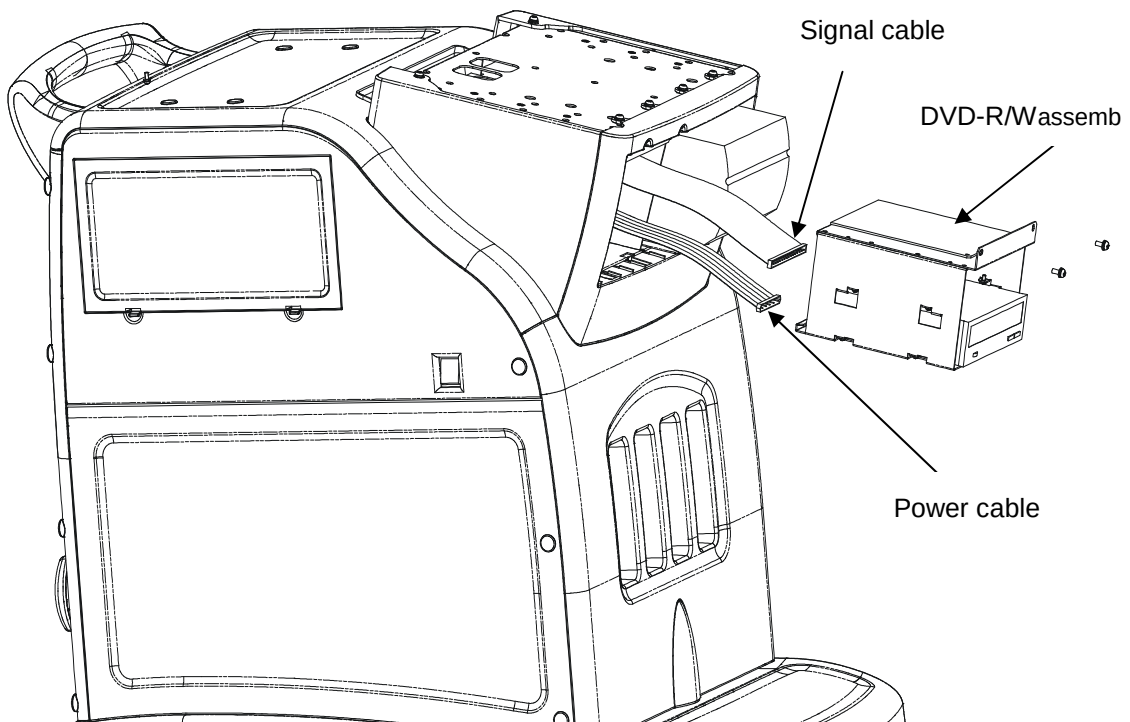


b) Remove the DVD-R/W assembly

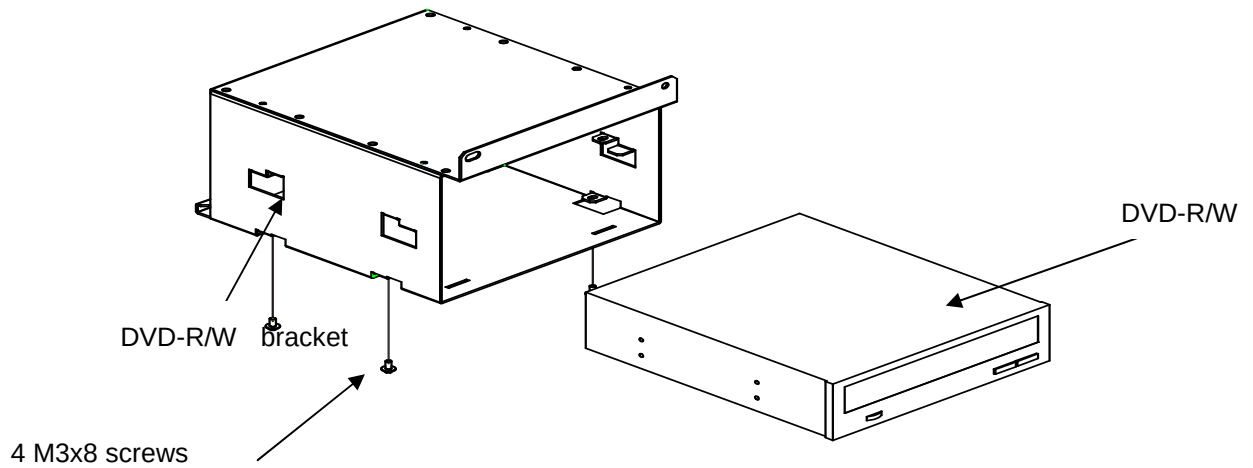
- (1) Remove the two M4×8 screws fixing the DVD-R/W assembly and main unit housing.



- (2) Remove the DVD-R/W assembly, and remove the power cable and signal cable.

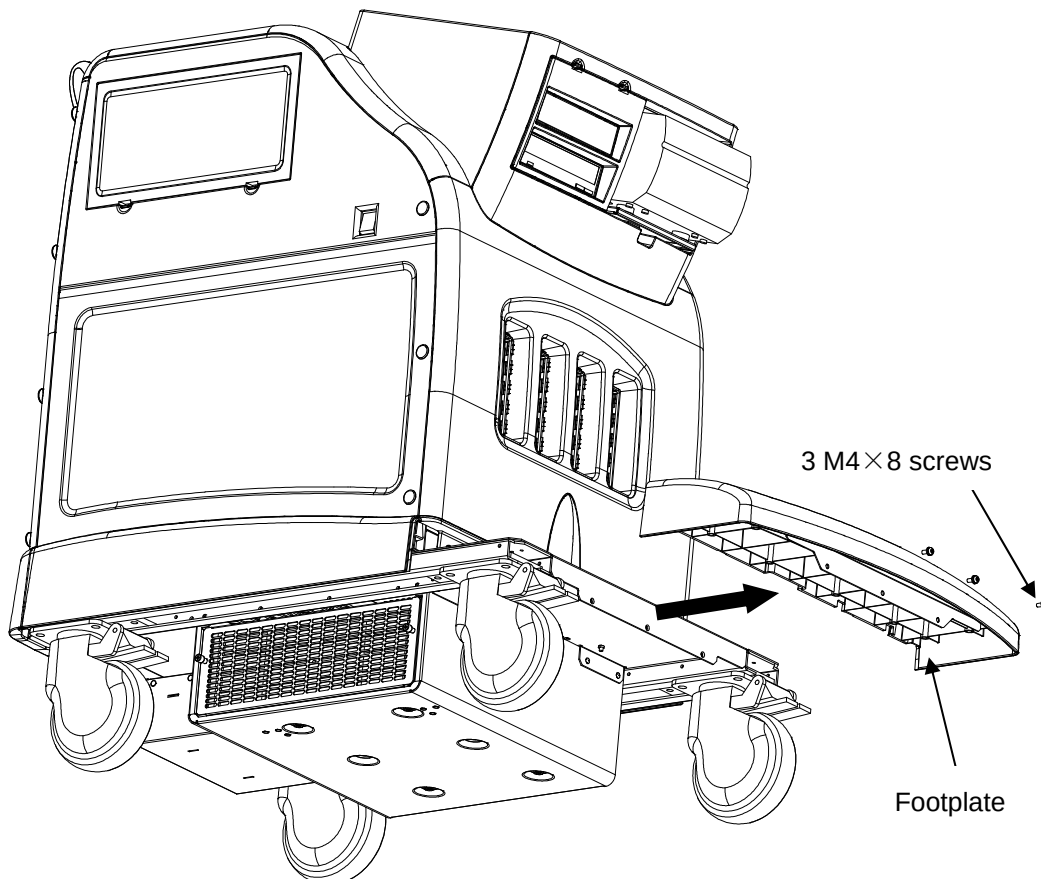


- c) Remove DVD-R/W: remove 4 M3x8 screws at the bottom of the DVD-R/W to take out the DVD-R/W



4.3.18 Remove the ECG assembly

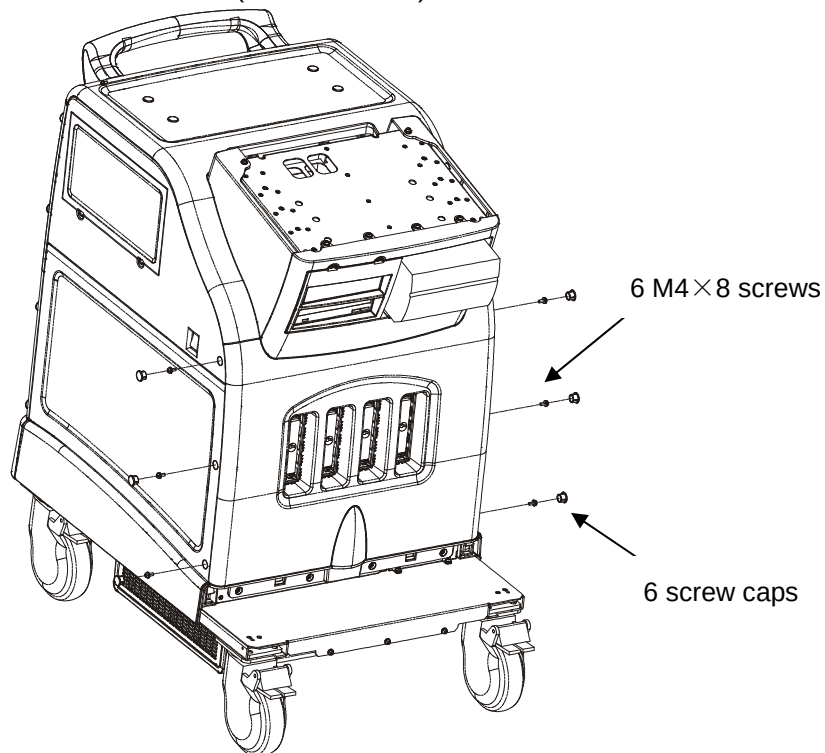
- a) Remove the footplate.
- (1) Remove 3 M4×8 screws at the bottom of the footplate assembly.
 - (2) Draw out the footplate assembly.



b) Remove the front cover of the main unit.

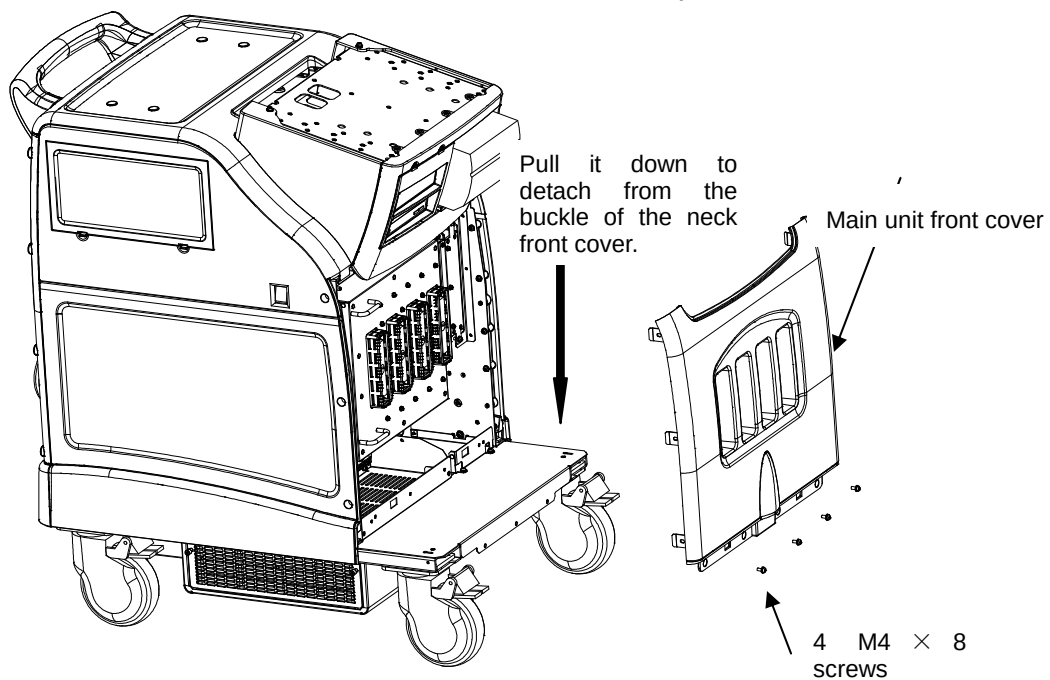
(1) Remove 6 screw caps on the left and right side plates (3 on each side).

(2) Remove 6 M4×8 screws (3 on each side).

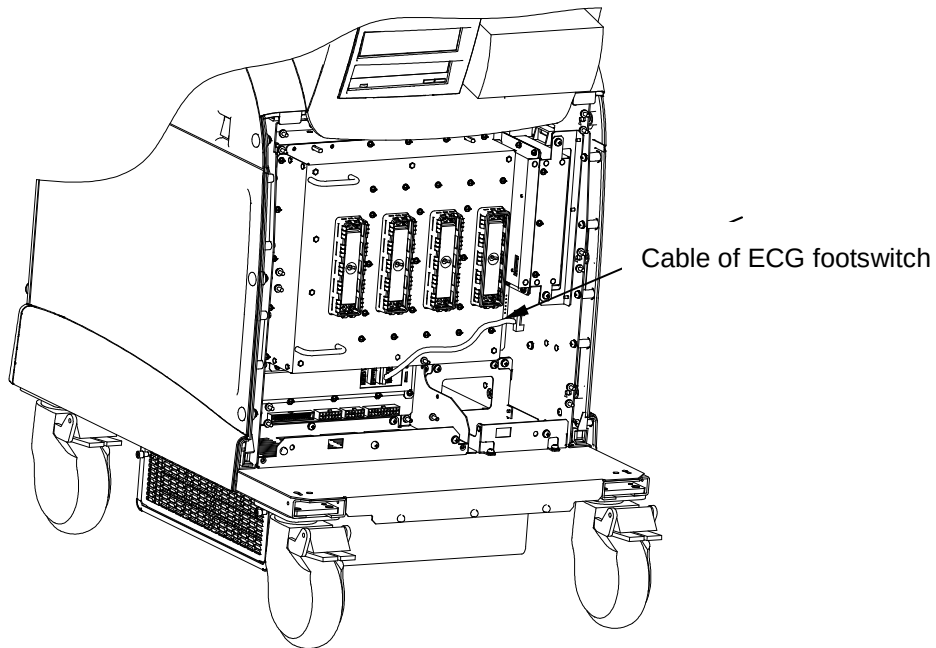


(3) Remove 4 M4×8 screws at the bottom of the front cover assembly of the main unit.

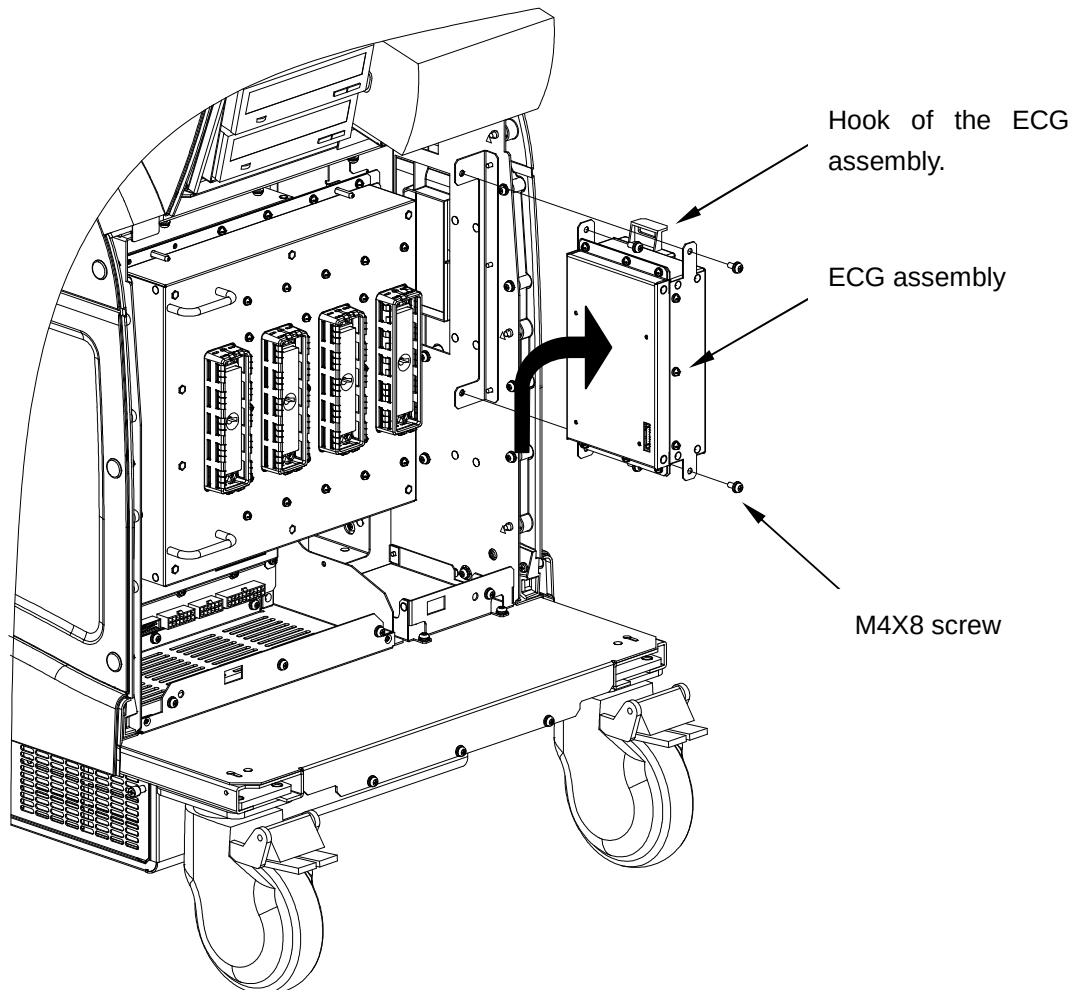
(4) First pull down the front cover assembly, and after it is detached from the buckle of the neck front cover, remove the front cover assembly of the main unit.



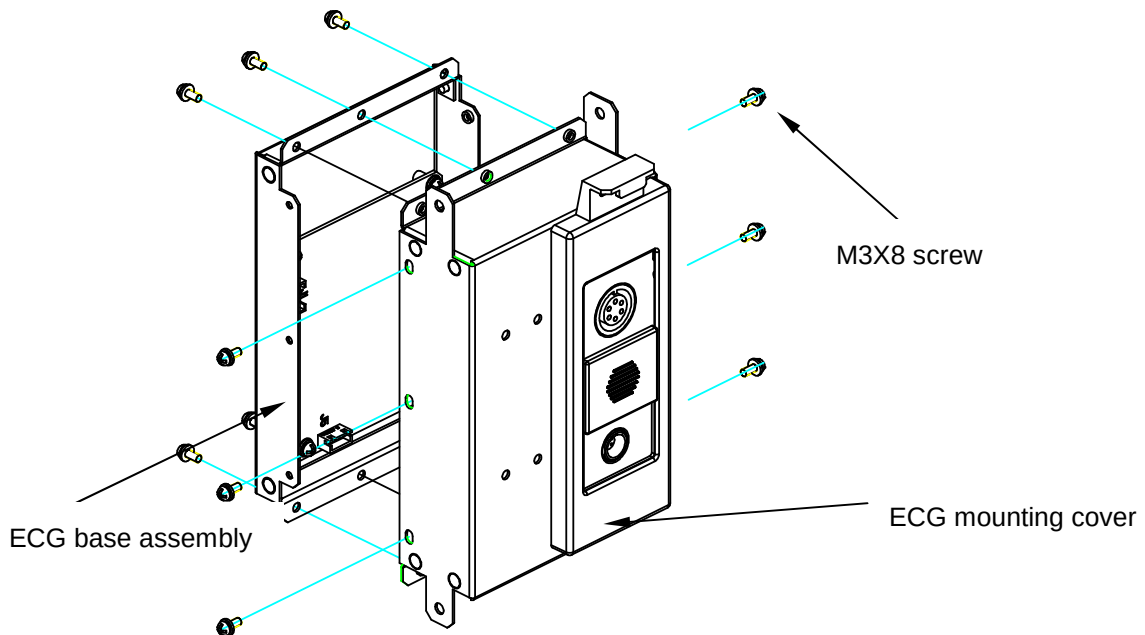
- c) Remove the cable of the ECG assembly.



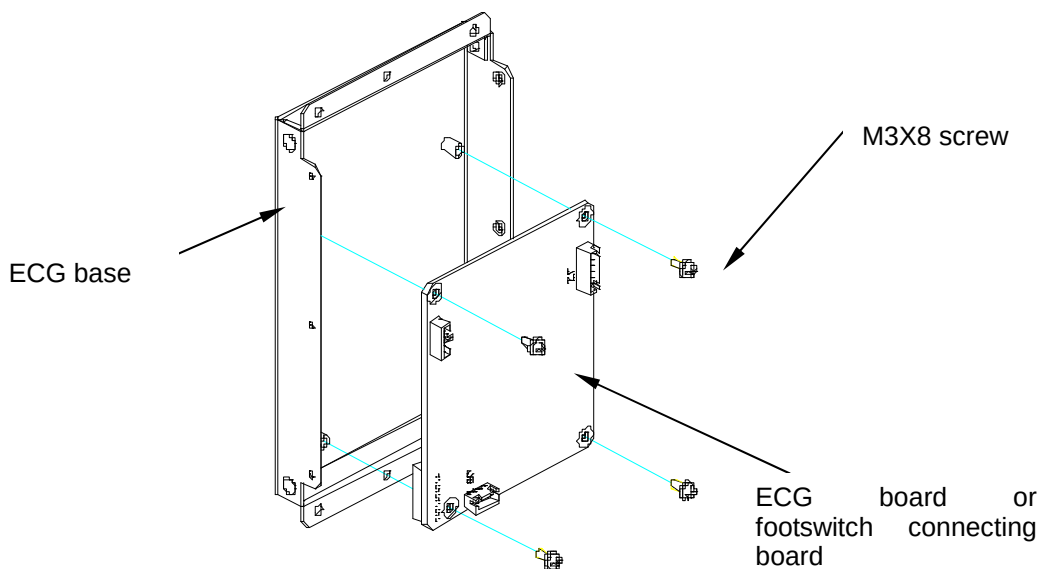
- d) Remove 4 M4 × 8 screws of the ECG assembly, pull it up until the ECG assembly is detached from the main unit housing, and remove the ECG assembly.



- e) Remove the M3X8 screw, disconnect the cables, and remove the ECG base assembly and ECG mounting cover.

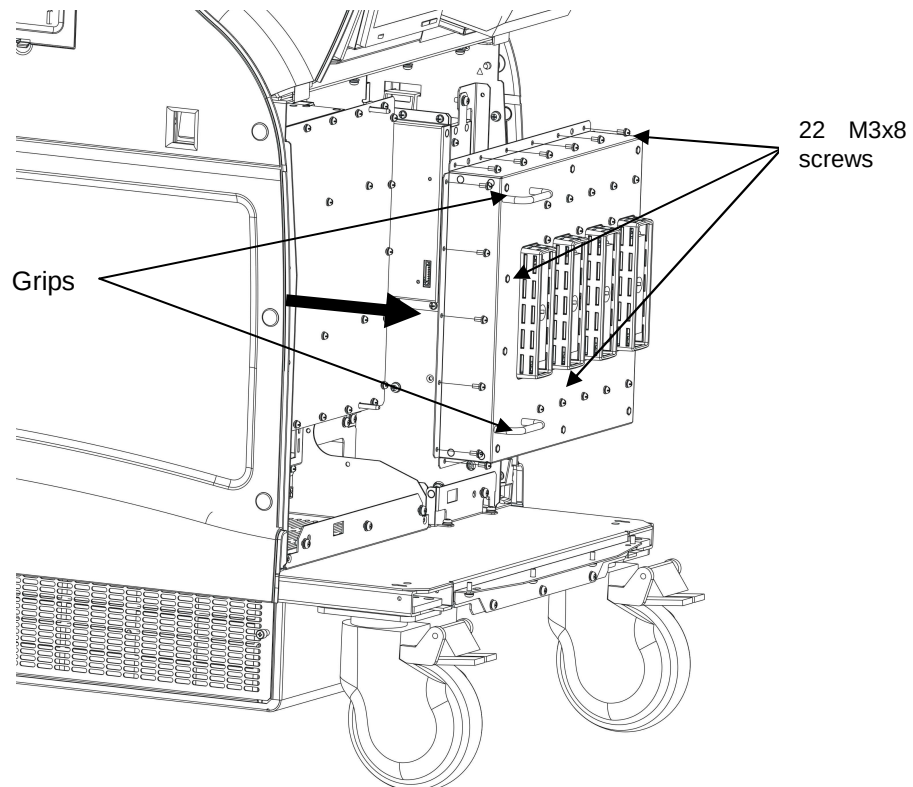


- f) Remove M3X8 screws, and replace the ECG board or footswitch connecting PCBA.

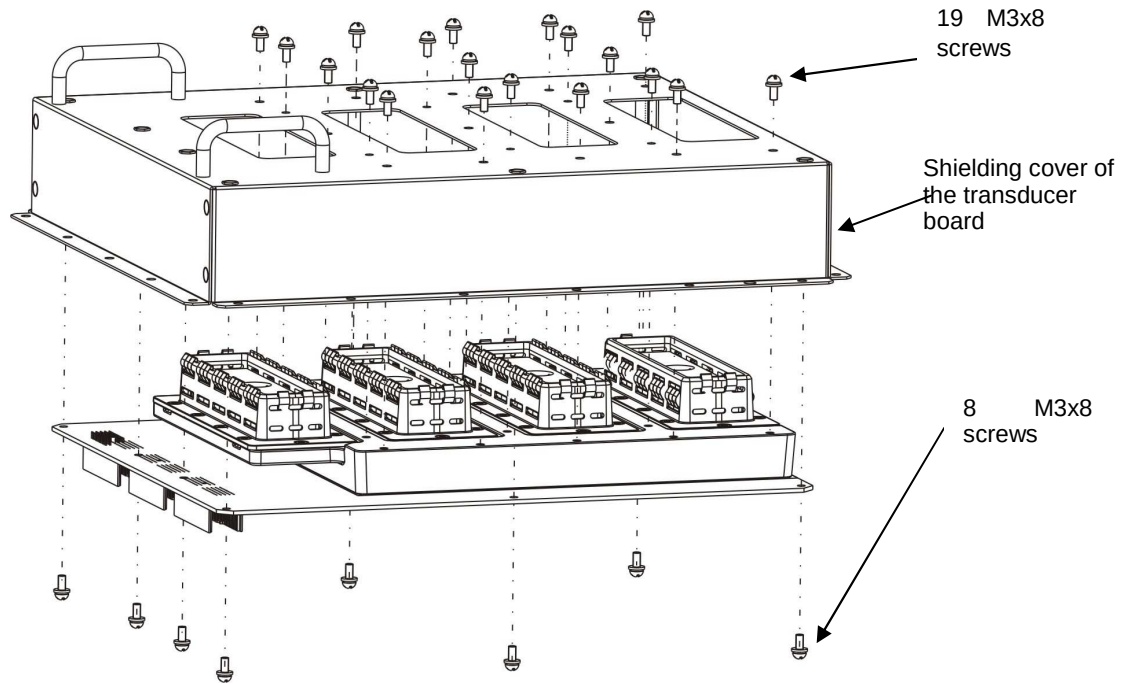


4.3.19 Remove the transducer board

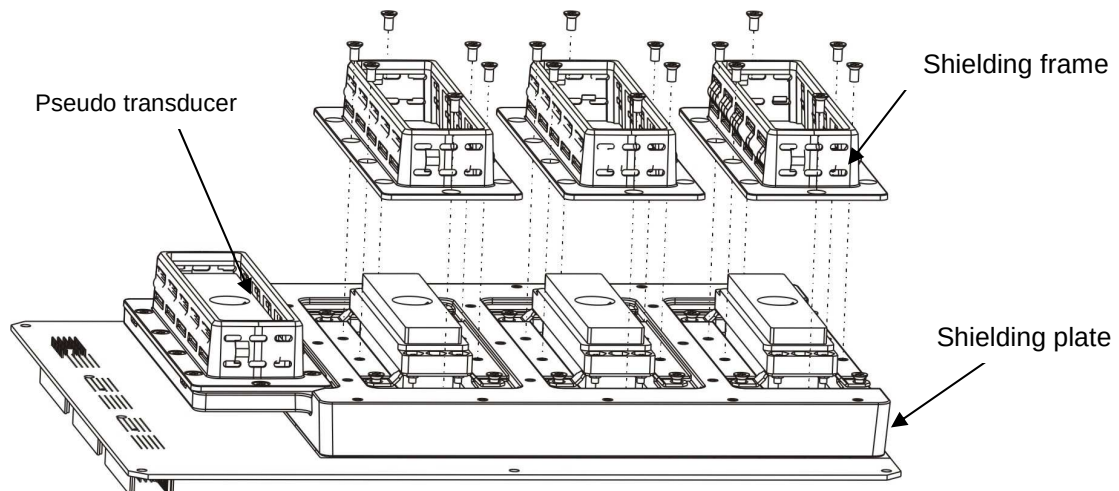
- a) Remove the transducer assembly: remove 22 M3x8 screws fixing the transducer assembly and main unit, hold the two grips to draw out the board; care shall be taken to avoid damage of interior connectors.



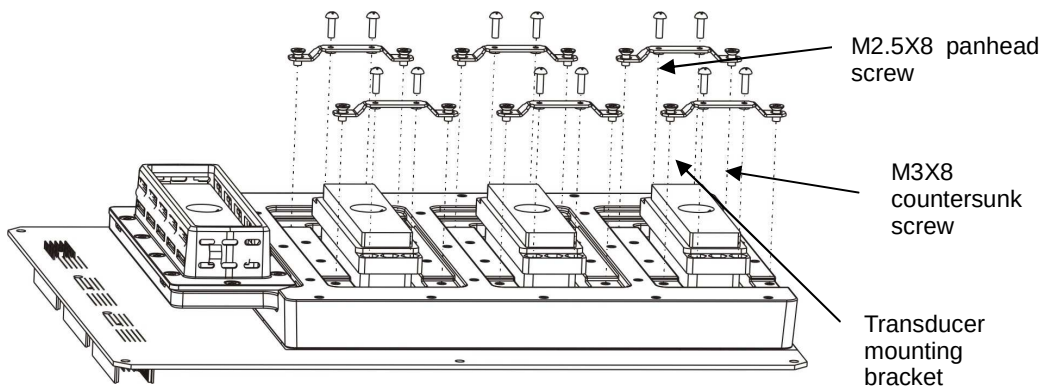
- b) Remove the shielding cover of the transducer board and aluminum shielding frames of the transducer sockets
- 1) Remove 19 M3x8 screws fixing the shielding cover of the transducer board and aluminum shielding frames, remove 8 M3x8 screws fixing the transducer board and shielding cover, and then remove the shielding cover of the transducer board.



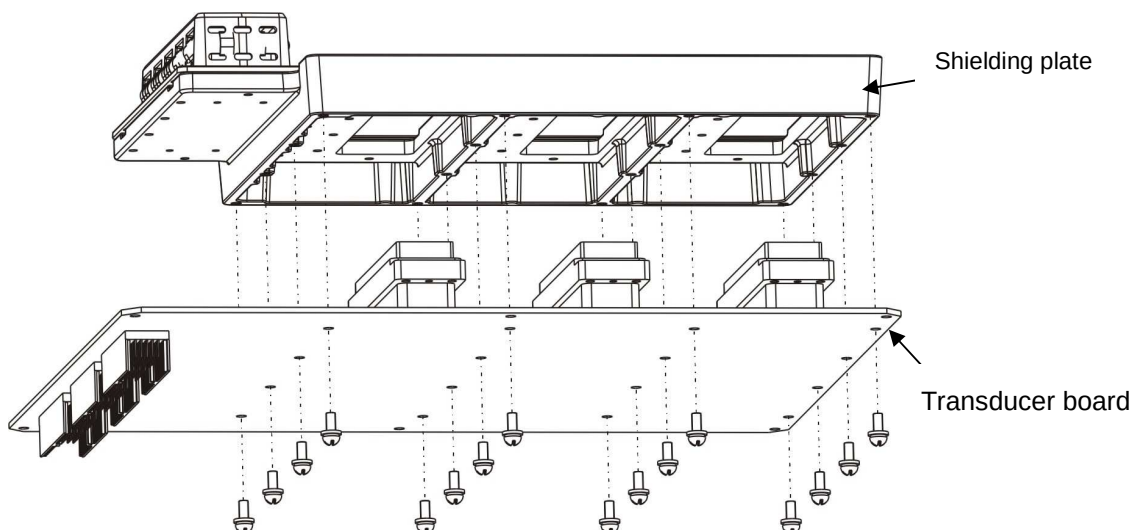
- 2) Remove 6 M3x8 countersunk screws fixing the shielding frames and shielding plates of the transducer sockets, and remove the shielding frames of the transducer, 3 in total (do not remove the pseudo transducer at the leftmost);



- 3) Remove 2 M3X8 countersunk screws for each transducer mounting bracket and shielding plate, remove 2 M2.5X8 panhead screws for the transducer socket and transducer mounting bracket, and remove the transducer mounting brackets (6 in total).

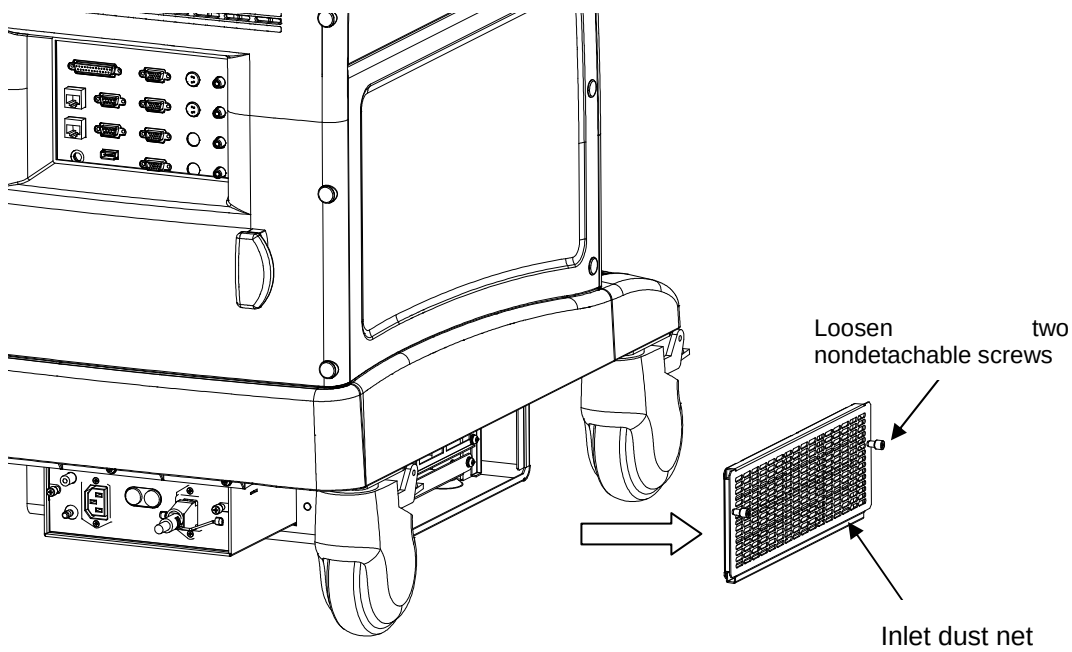


- 4) Remove 12 M3x8 screws for the transducer board and shielding plates, and separate the shielding plates and transducer board.

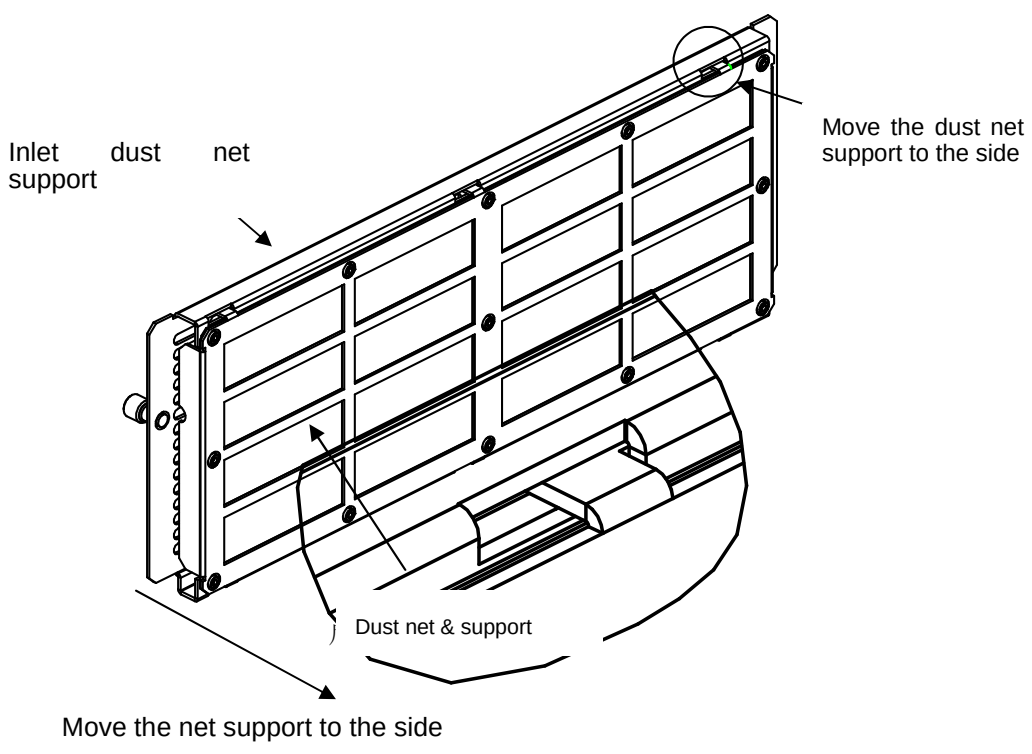


4.3.20 Replace the inlet dust net

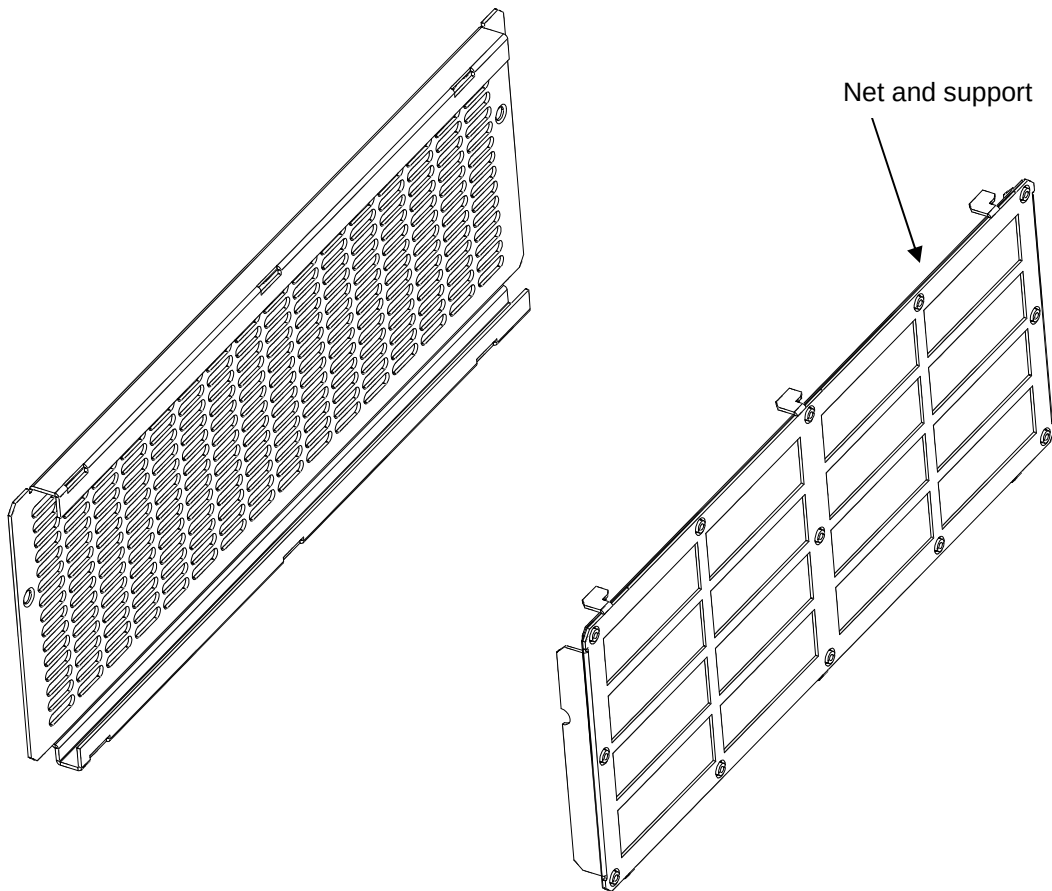
- a) Loosen two nondetachable screws for two inlet dust nets and main unit housing, and take out the inlet dust net from the left side of the system.



- b) Move the dust net support to the side until it is detached from the hook, and take out the net support.

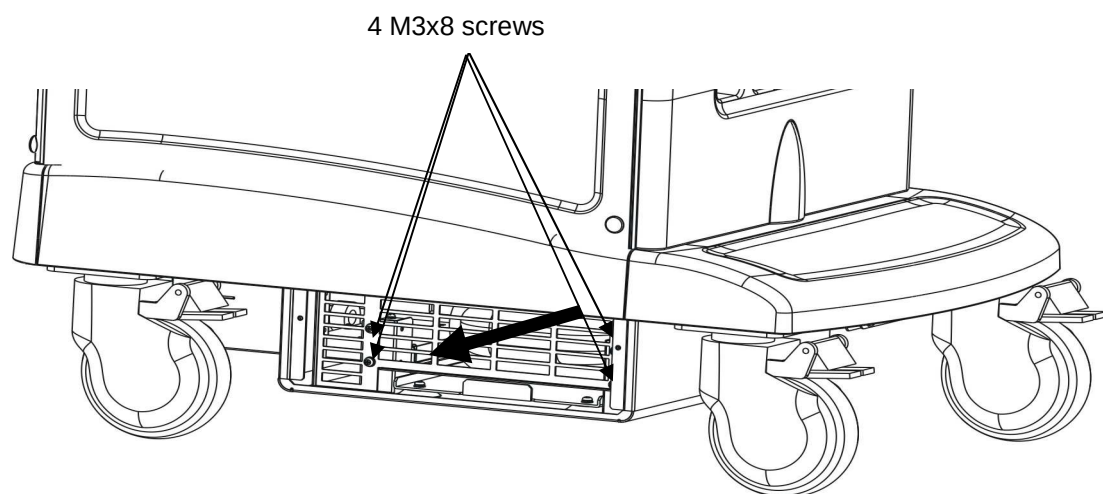


- c) Replace the net and the net support with new ones.



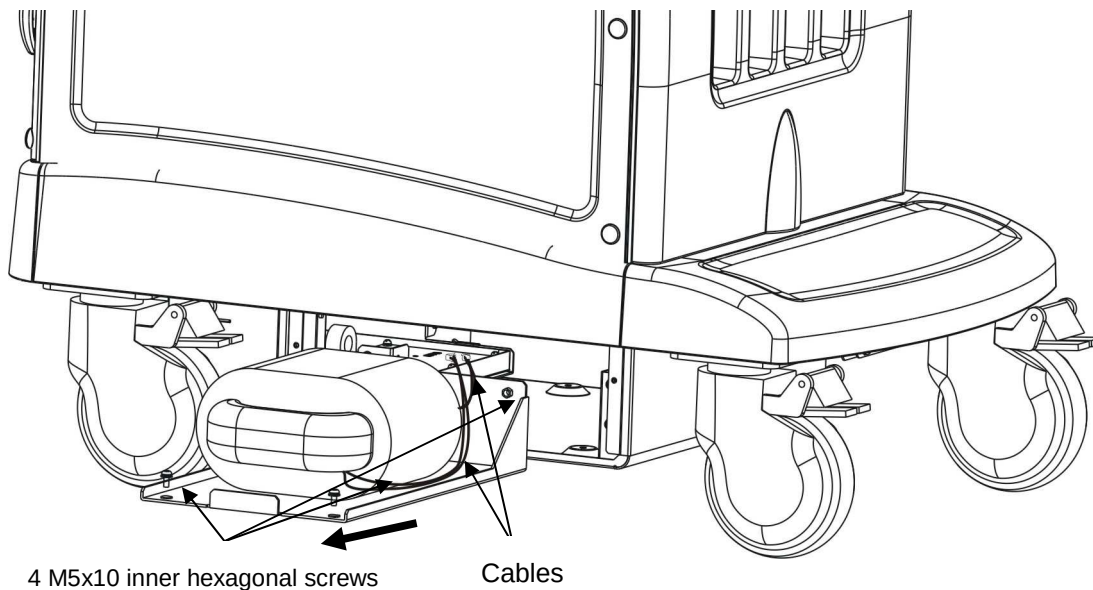
4.3.21 Remove the transformer

- a) Remove the inlet dust net as per the step a in section 4.2.18.
b) Remove 4 M3x8 screws of the separating plate of the transformer, and take out the separating plate.



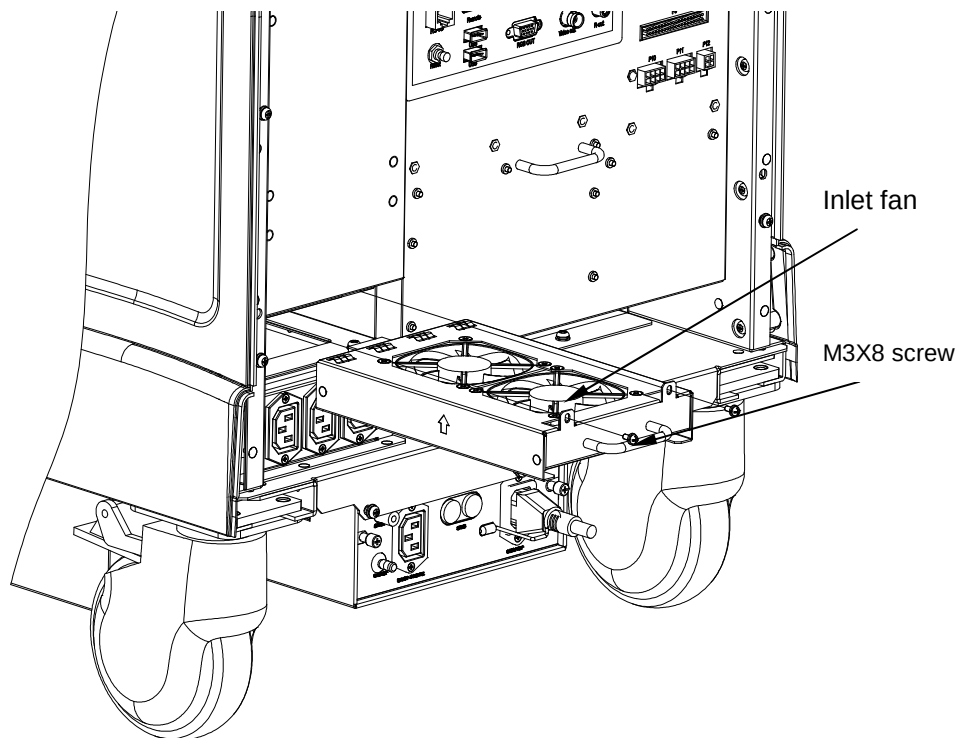
- c) Remove 4 inner hexagonal screws separating the transformer (2 screws at the

bottom of the right side), draw out the transformer from the left side, disconnect the input and output cables of the transformer, and take out the transformer.



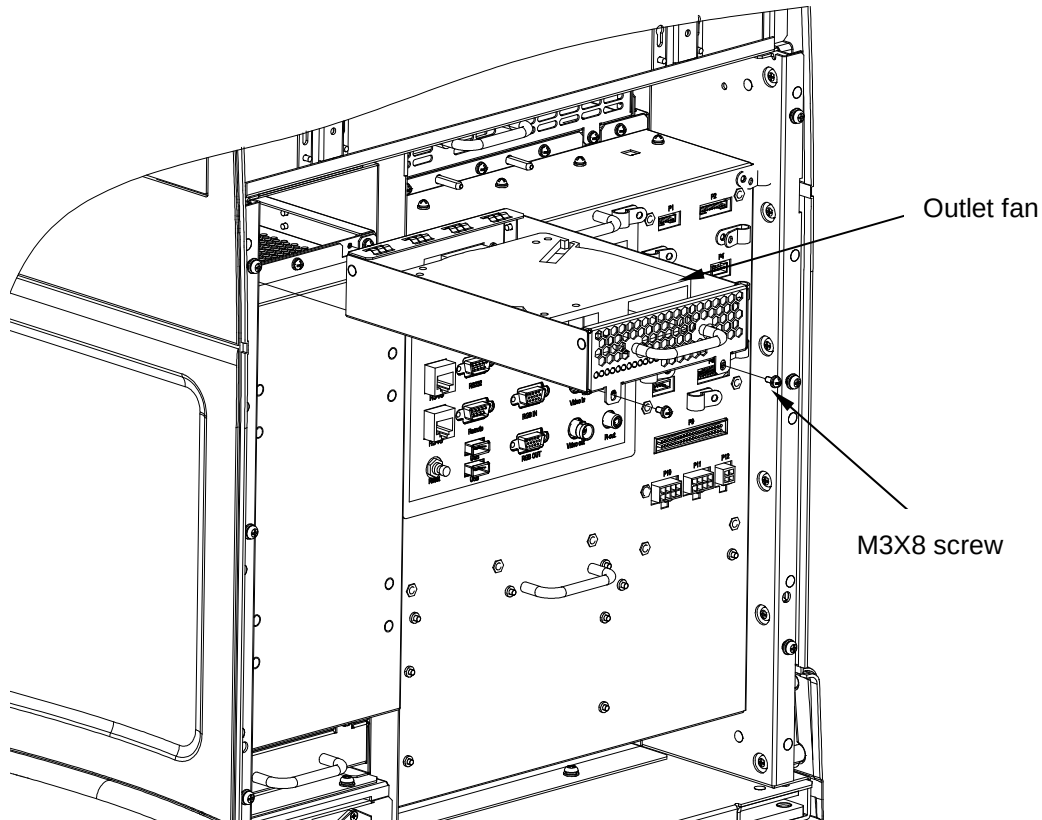
4.3.22 Remove the fan assembly

- a) Remove the inlet fan of the power main unit box.
 - 1) Remove the main unit rear cover.
 - 2) Remove 2 M3×8 screws of the inlet fan assembly.
 - 3) Hold the grips, and draw out the inlet fan assembly.

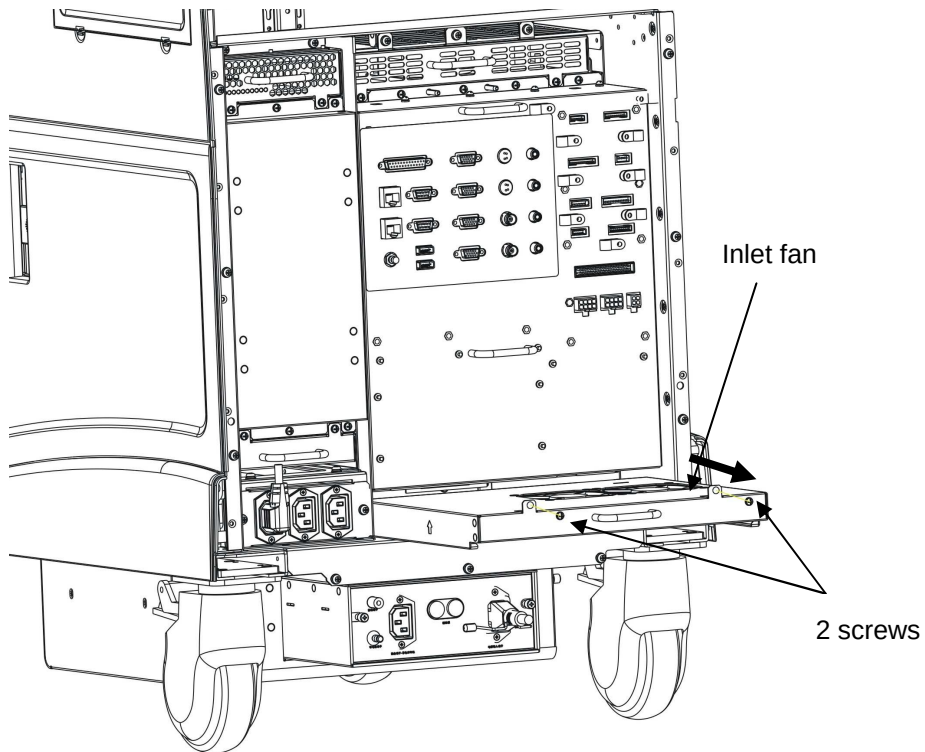


- b) Remove the outlet fan of the power main unit box.

- 1) Remove the main unit rear cover.
- 2) Remove 2 M3x8 screws of the inlet fan assembly.
- 3) Hold the grips, and draw out the outlet fan assembly.

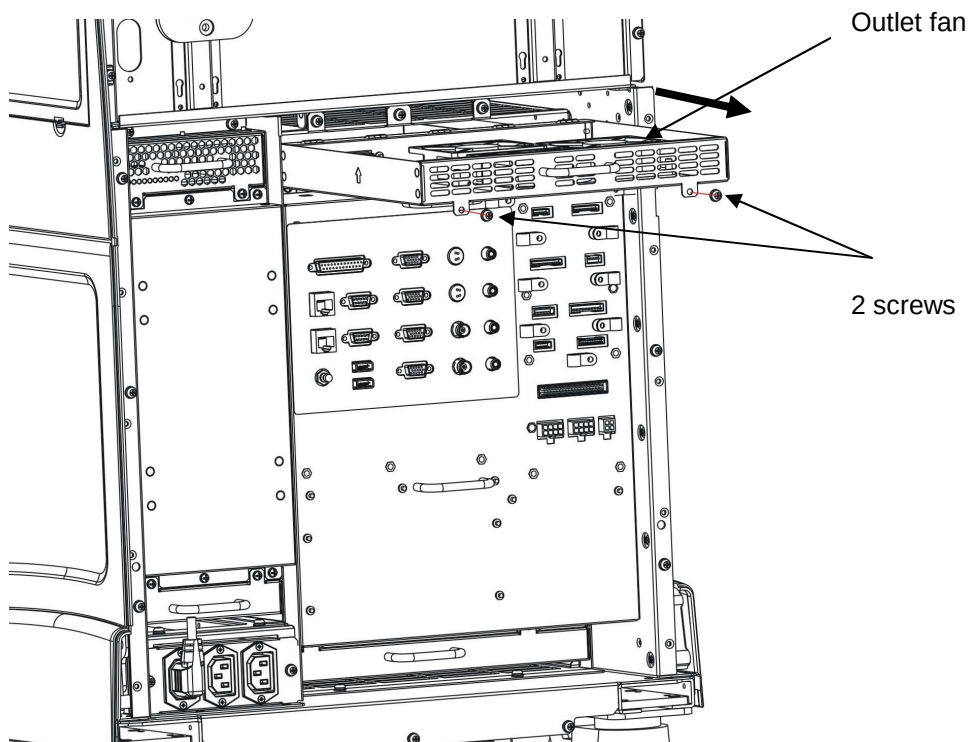


- c) Remove the inlet fan of the system main unit housing.
- 1) Remove the main unit rear cover.
 - 2) Remove 2 M3x8 screws fixing fan frame.
 - 3) Hold the grips, and draw out the inlet fan assembly.



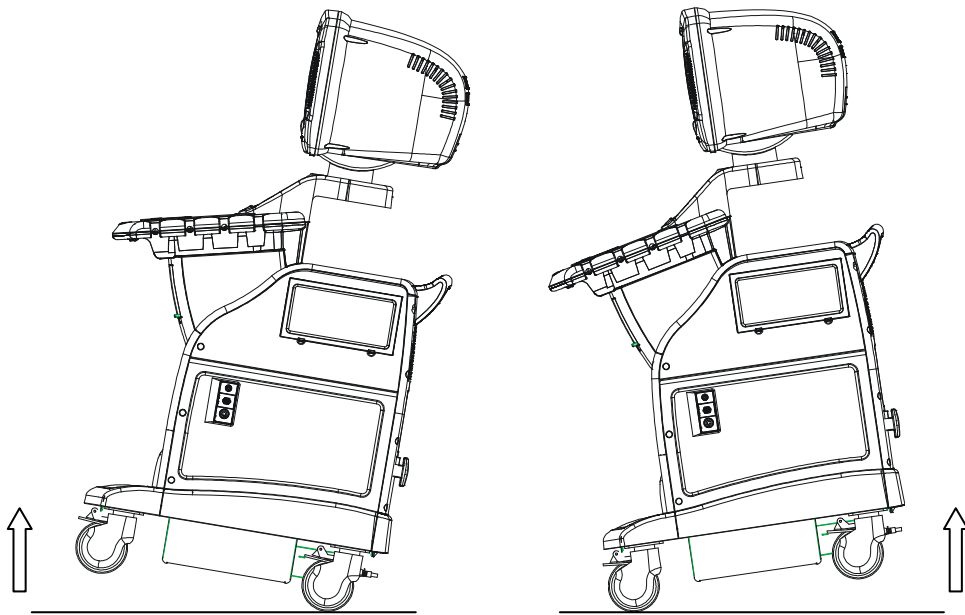
d) Remove the outlet fan of the system main unit housing.

- 1) Remove the main unit rear cover.
- 2) Remove 2 screws fixing fan frame.
- 3) Hold the grips, and draw out the outlet fan assembly.

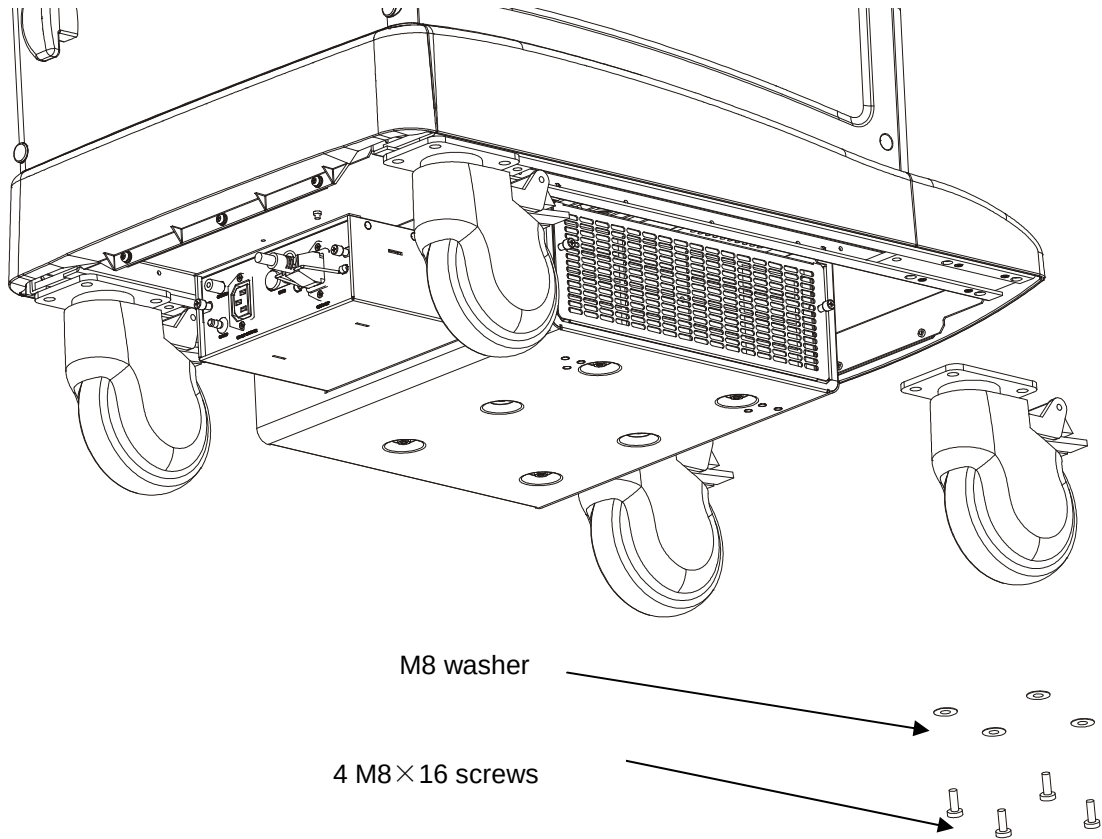


4.3.23 Replace casters

- a) Brake the two casters which aren't to be replaced (front or rear).
- b) Place a jack (maximum load: over 100 kg) in the mounting area of casters, and lift the two casters at the same time, thus the system doesn't topple to one side.
- c) Place a piece of wood in the middle of the front or rear bottom (width: 150 mm $\times$ length: 150 mm $\times$ height: 150 mm).



- d) Use an inner hexagonal wrench to loosen 4 M8X16 inner hexagonal screws, take out 4 M8 washers, and remove the casters for replacement.



- e) Put washers on the new casters and use a torque wrench to tighten the casters.

Torque: 15 N·m

If the torque wrench isn't available, apply a force of 75 N to the wrench in the position 20 cm away from the axis of rotation.

4.4 Installation of Peripherals

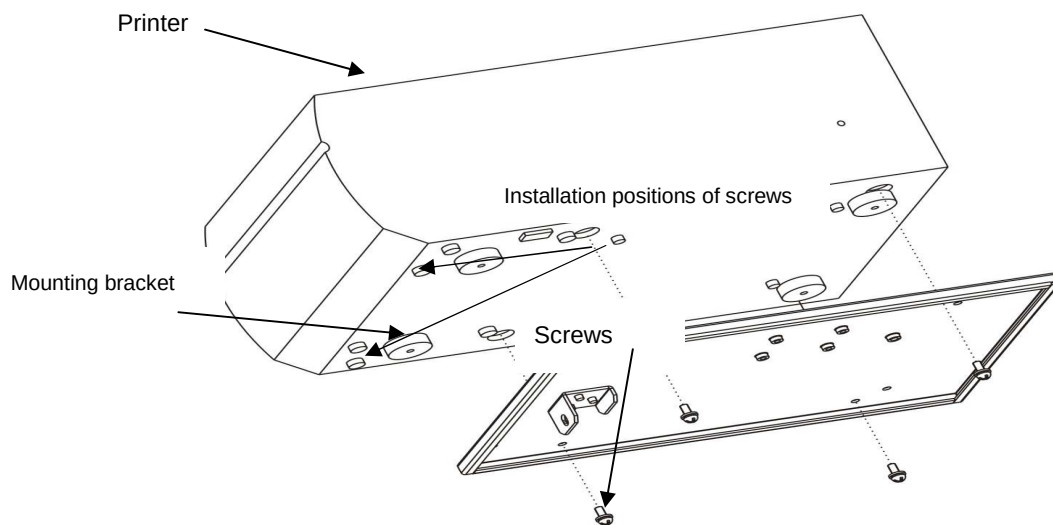
4.4.1 Installation of black/white video printer

1. Remove 4 M3X8 cross panhead screws and 1 M4X8 cross panhead screws from the bracket.

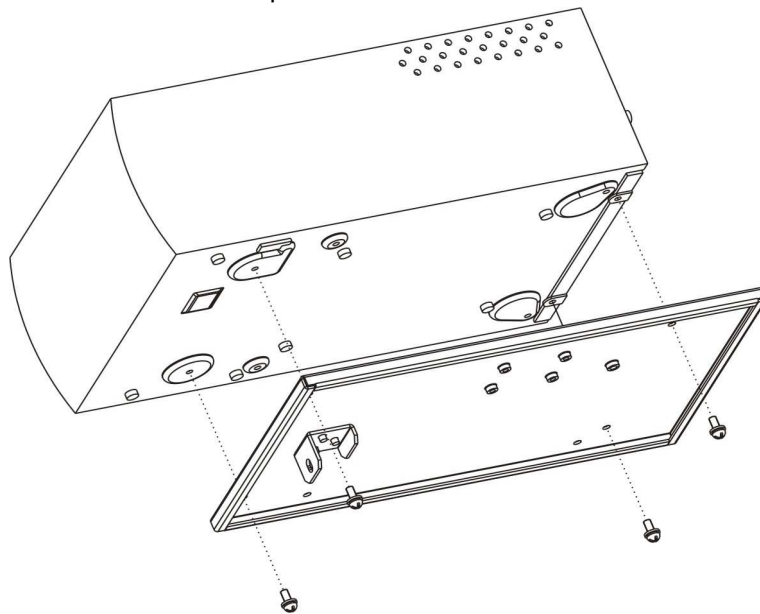
Note: the five screws mentioned above are all on the bracket of the printer for use.

2. Use the 4 M3X8 cross panhead screws to fix the printer and the bracket.

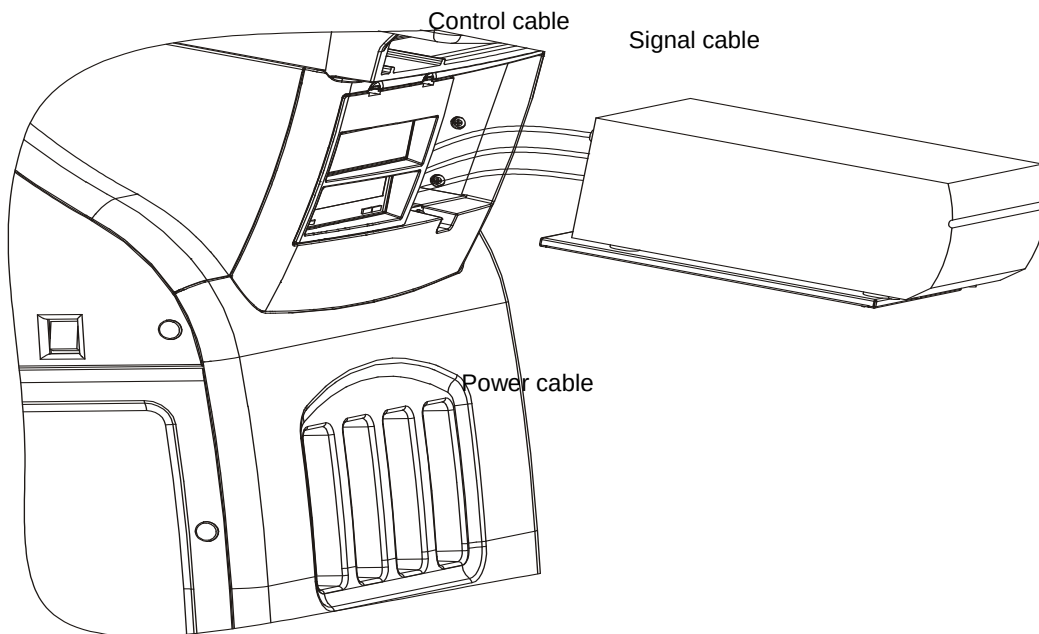
Installation of the P93W printer



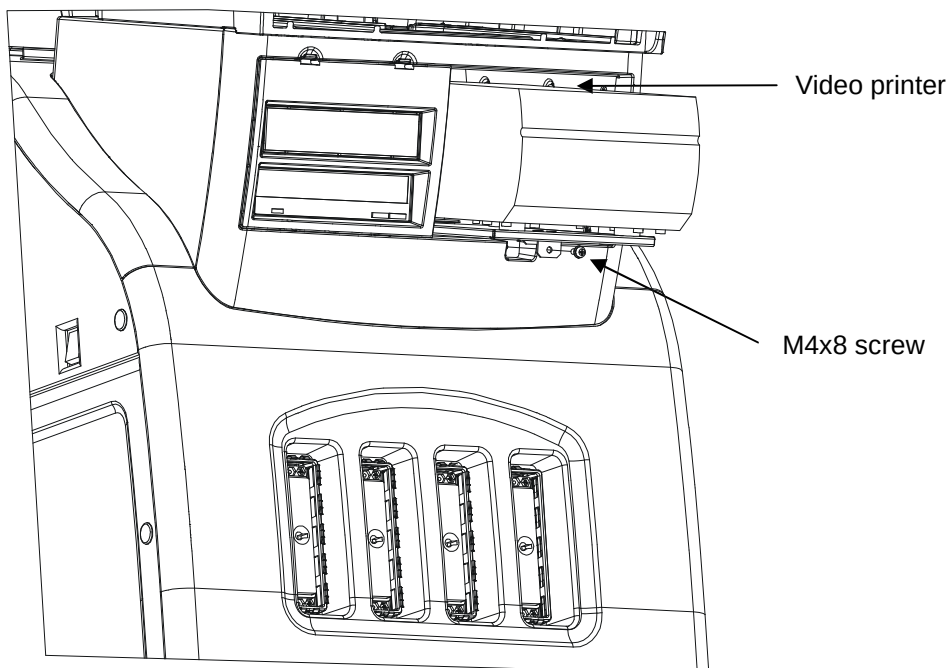
UP897MD video printer



3. Connect the power cable, control cable, and signal cable reserved in the peripheral bay to the printer



4. Place the printer inside the peripheral space, lift it slightly to grab it (to avoid slippage of the printer), and tighten the M4X8 screws for the video printer and the main unit.

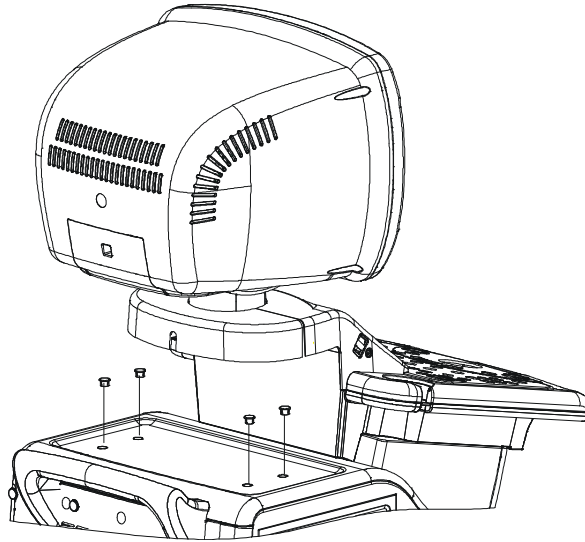


4.4.2 Installation of color video printer

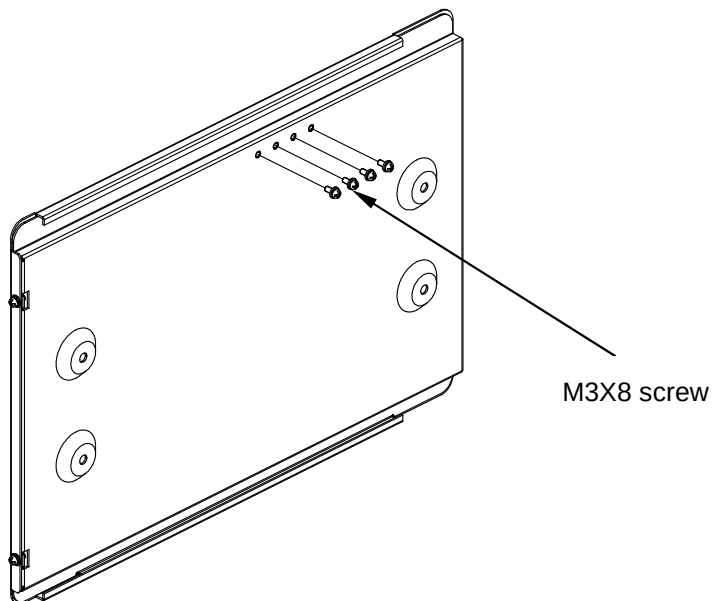
There are two steps for installation of the color printer: 1) installation of the printer cables; 2) installation of the color printer. The optional printers are of two models: 1) Sony UP-20; 2) MITSUBISHI CP-910E printer.

Note: For the MITSUBISHI CP-910E printer, set the parameter to "ON" via *SERVICE MENU->KEY SET->MEM & PRN*.

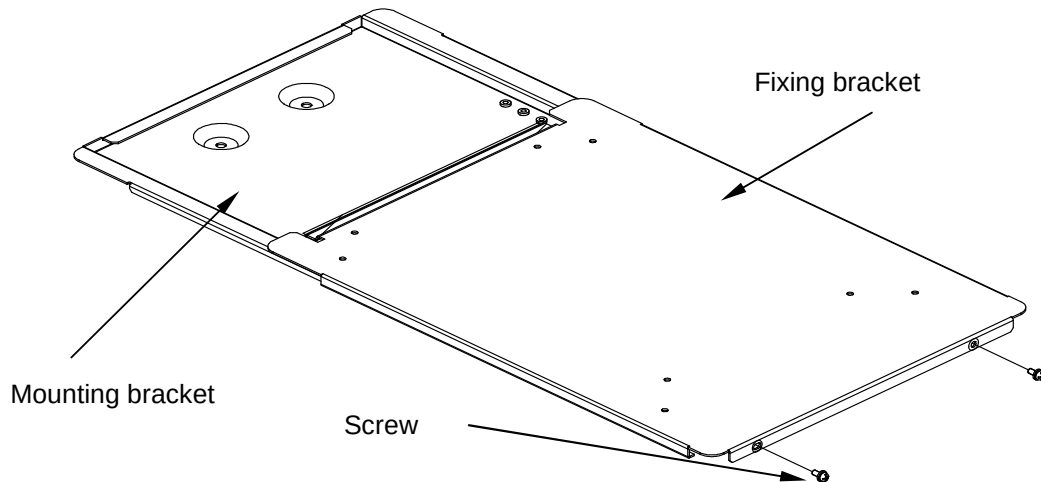
1. Remove four screw caps on the top from the system, and store them in a plastic bag.



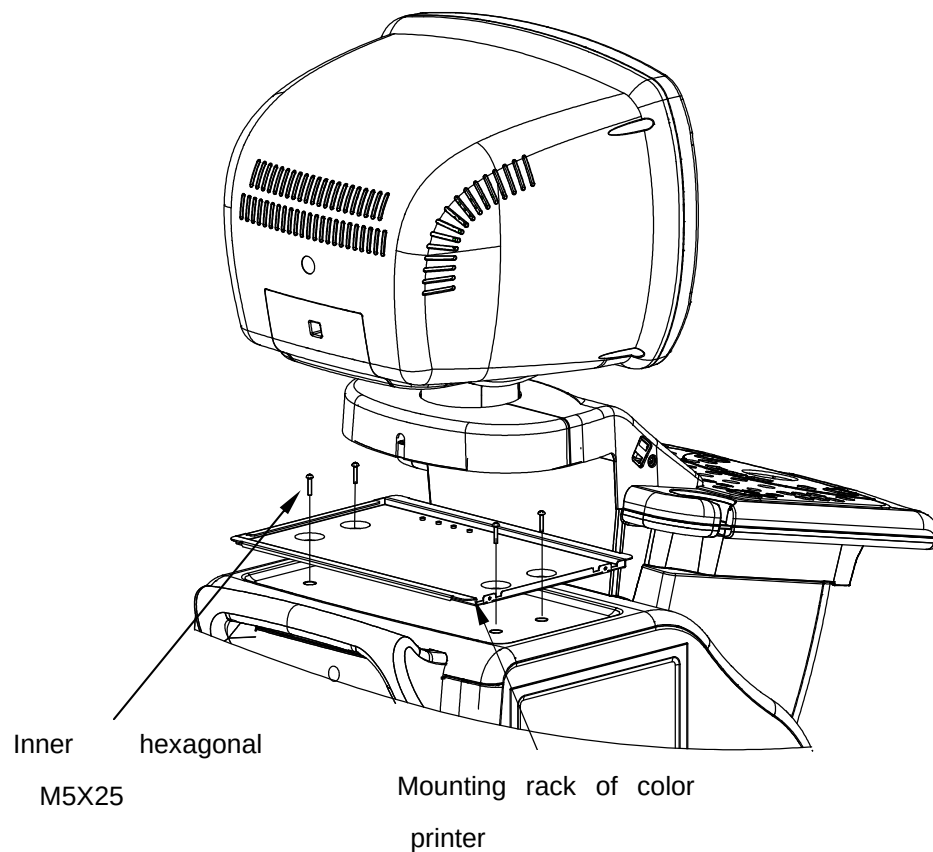
2. Take out the fixing bracket and mounting bracket of the color printer, and remove 4 M3X8 screws on the mounting bracket.



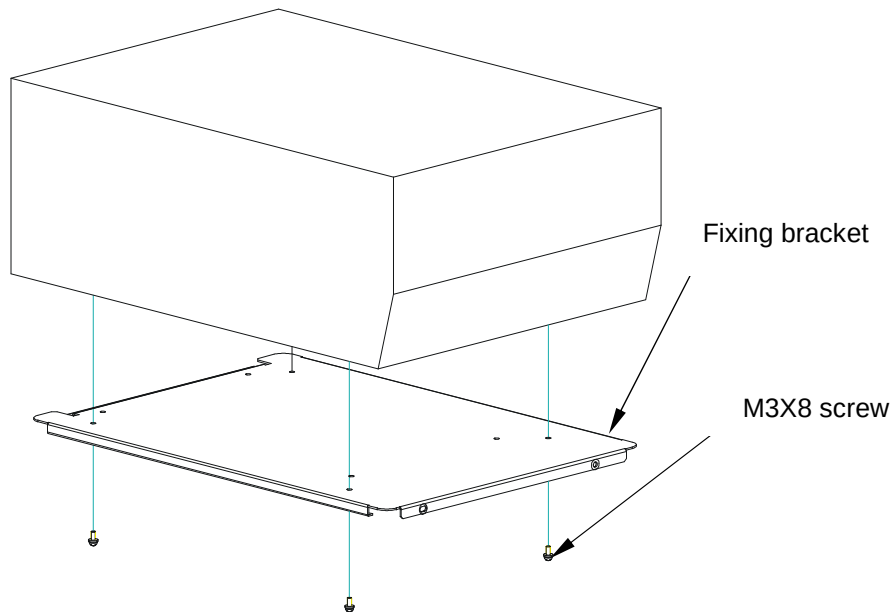
3. Remove 2 screws fixing the fixing bracket and remove the fixing bracket.



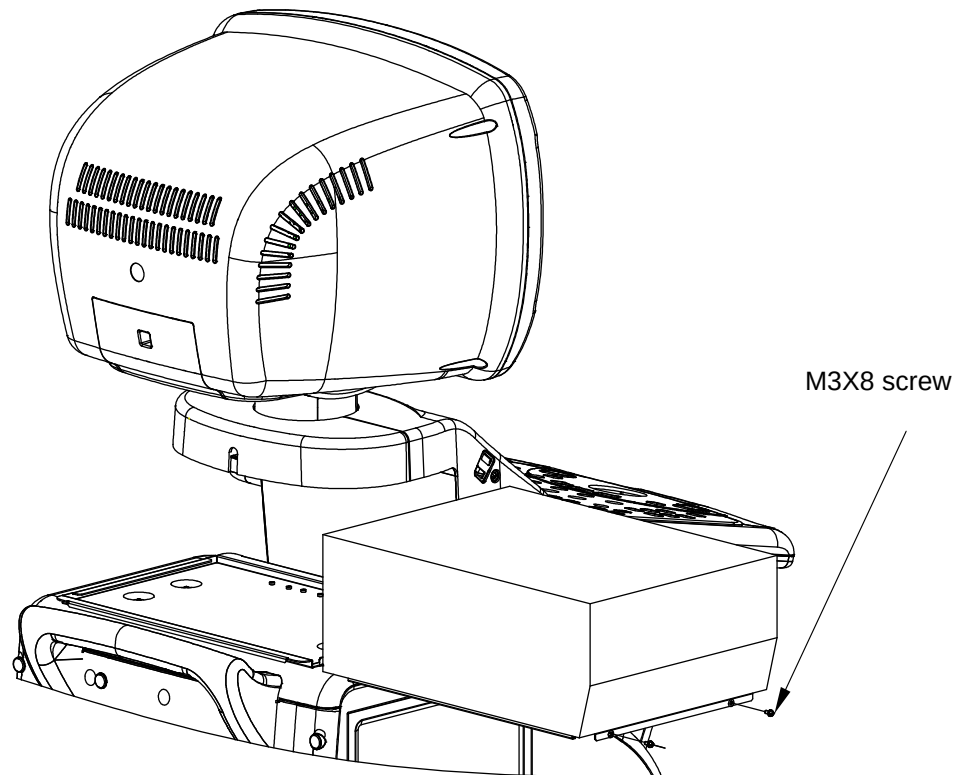
4. Open the plastic bag to take out the four M5×25 screws, and install the mounting bracket on the system. (Note: the side which has screw thread shall face to the left side of the system.)



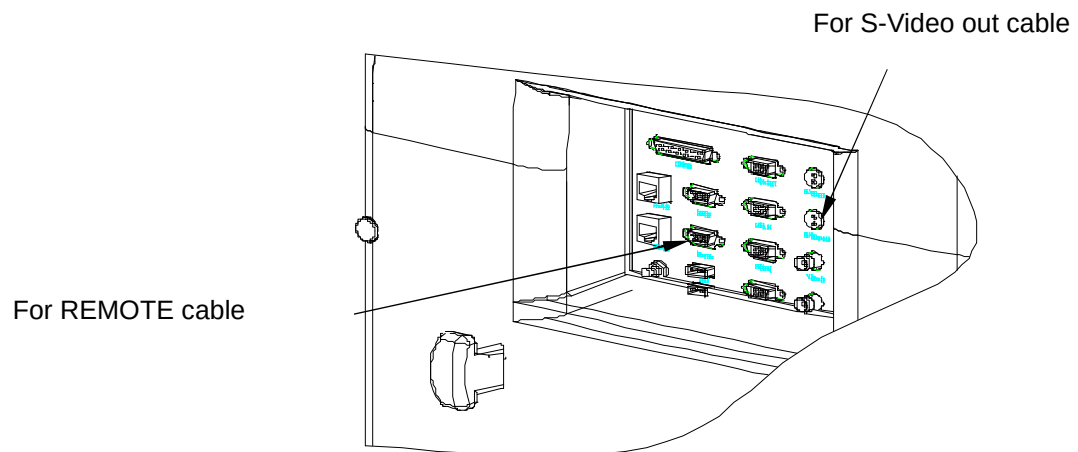
5. Use the screws to fix the printer on the fixing bracket. Note that the side which has holes shall face to the front of the printer.



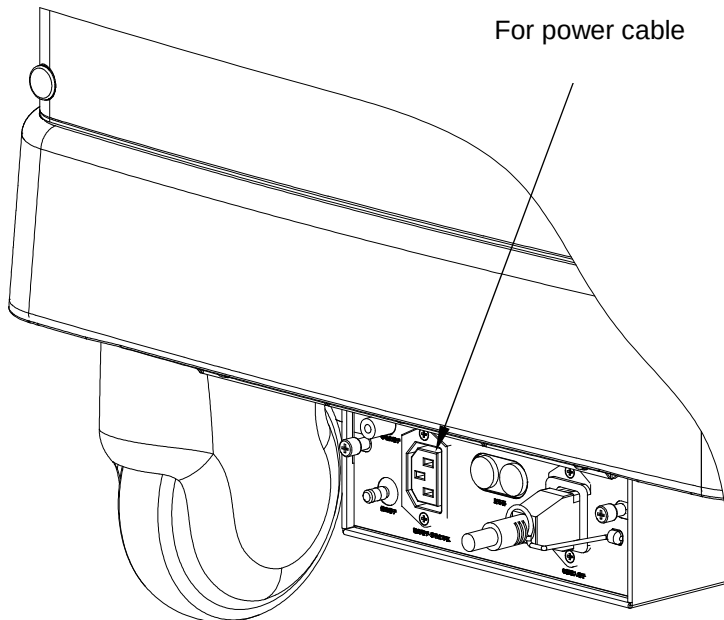
6. Place the fixing bracket on the mounting bracket, and push it inside the mounting bracket. Note the guides of the fixing bracket and mounting bracket shall match well and be fixed with screws.



7. Connect the signal cable and power cable.



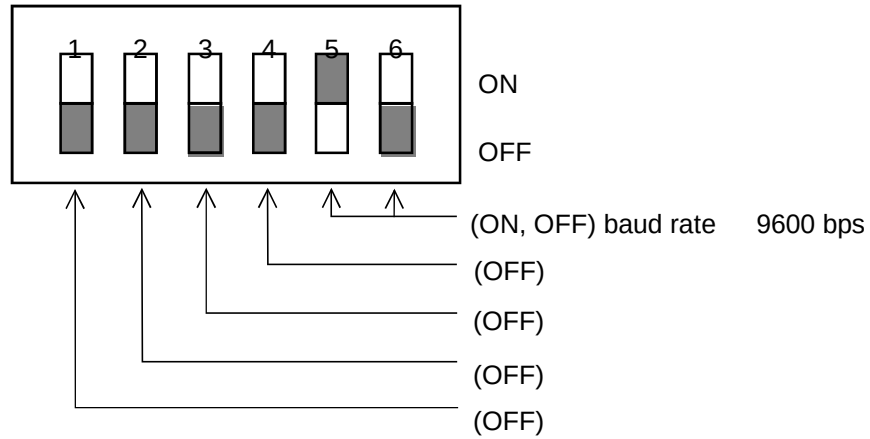
Connection of signal cables of the color printer



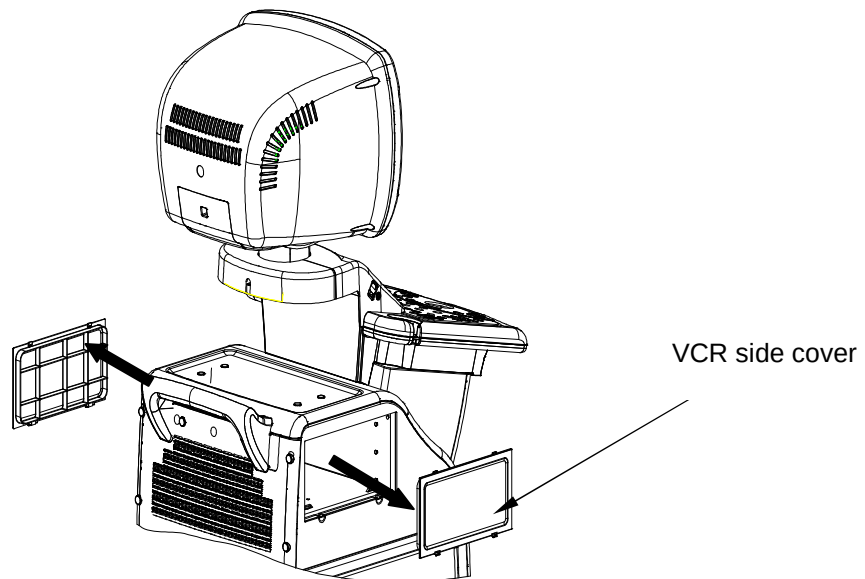
4.4.3 Installation of VCR

1. First confirm the configuration of the VCR's DIP switches.

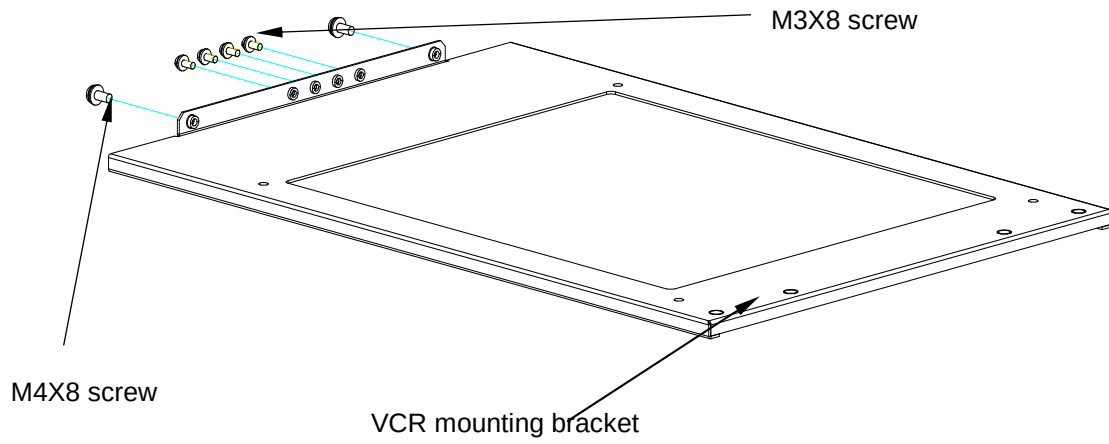
- SONY SVO-9500MD



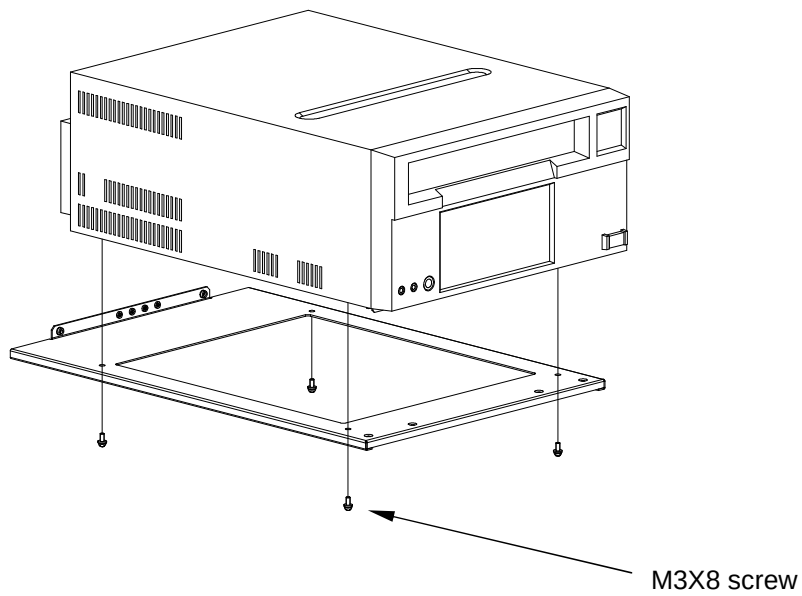
2. Remove the two side covers of VCR.



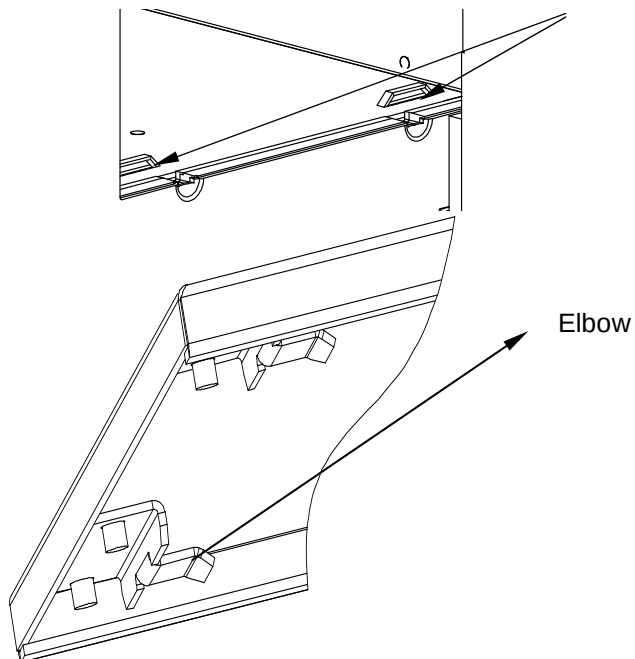
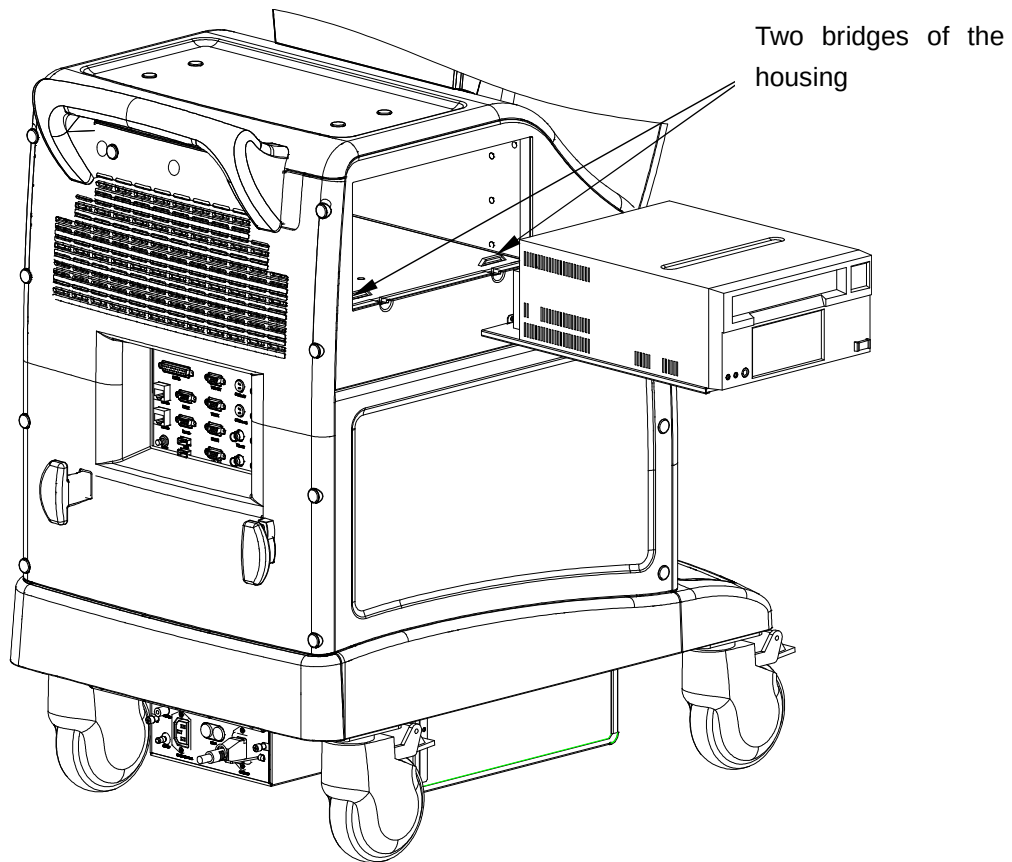
3. Take out the VCR mounting bracket from the package, and remove the screws fixed on the mounting bracket.



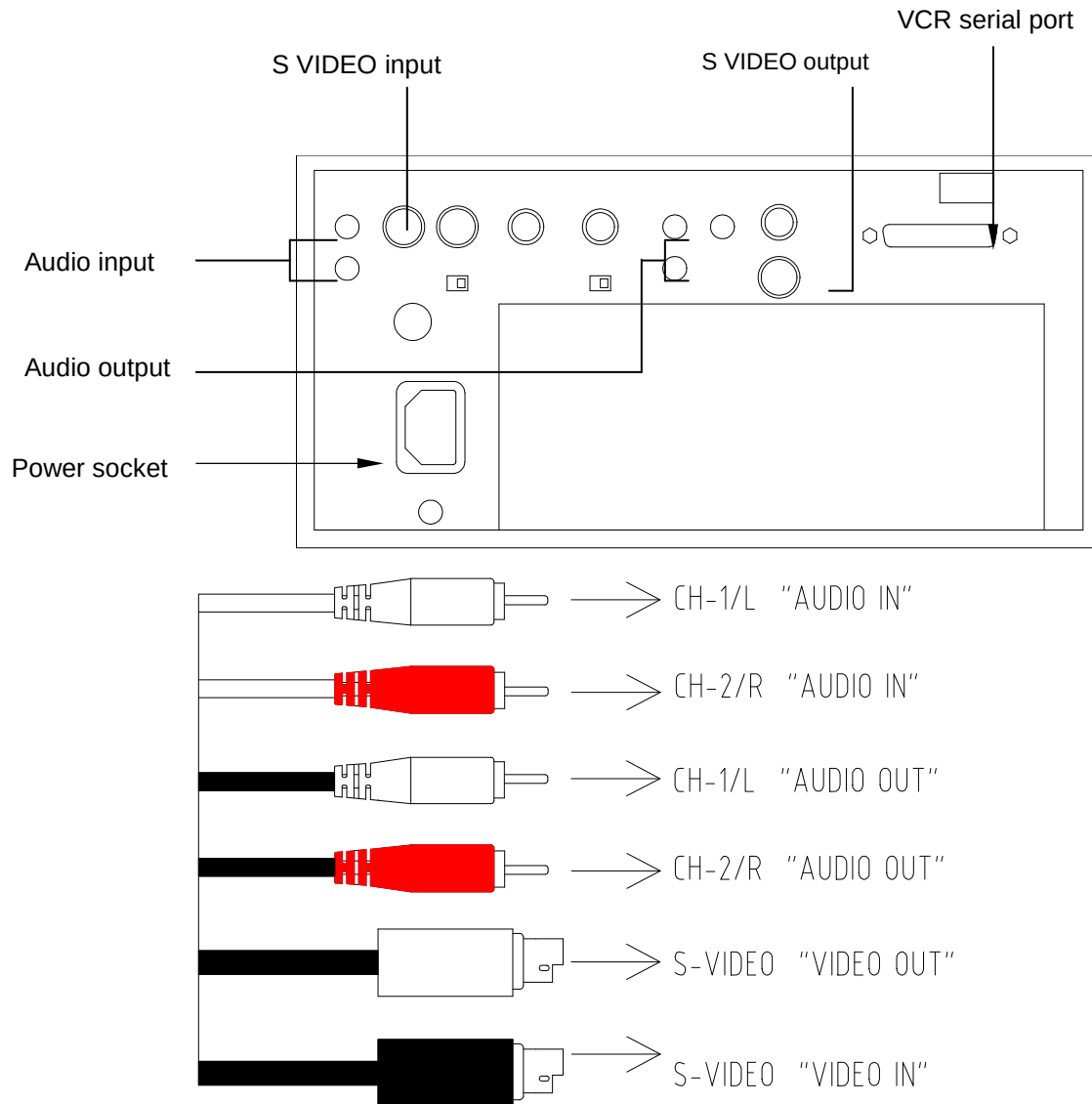
4. Fix the VCR using four screws.



5. Push the VCR and bracket into the peripheral bay, ensuring that the two elbows below the mounting bracket insert to the two bridges of the housing, and the other side is fixed by two M4×8 screws.



6. Connect the power cable and signal cable (to alternative of S VIDEO connectors). The audio IN/OUT and S VIDEO IN/OUT cables are integrated into one strand of cables for the VCR module.



7. Install the right cover, but store the left cover properly.

5

Maintenance Requirements

5.1 Tools Required

5.1.1 Tools/measurement devices and consumables

Table 5-1 Tools and measurement devices

Tools/measurement devices	Quantity	Remarks
Resin or stainless steel container	1	Large enough to accommodate two transducers
Plastic bags	1	Approx. 2 m × 2 m (0.3 mm in thickness)
Vacuum cleaner	1	
Blower (600W ~ 16000 mm/min)	1	Makita 4014NV or equivalent
Cleaner		
Brush	1	As small as a toothbrush
Air spray or blower brush	1	For cleaning the fans

Table 5-2 Consumables

Consumable	Quantity	Remarks
Aluminum foil	1	
Physiological saline solution (0.85 to 0.95% saline solution)	-	The saline container should be filled.
Glass cleaner	1	For cleaning the monitor
Neutral detergent		
Soft rag		

- ⚠WARNING:**
1. Do not use solvents (such as paint thinner or benzine) or abrasive cleansers for cleaning the system. These substances may cause deterioration in the system.
 2. Do not use hydrocarbon glass cleaner or cleaner for the OA equipment to clean the monitor. This substance may cause deterioration in the monitor.

5.1.2 Standard configuration of tools and consumables

Tools list

Tool	Type	Manufacturer	Specifications/standards
Screwdriver (various sizes and types)			(Not specified)
Screwdriver (various sizes and types)			(Not specified)
Stubby Phillips screwdriver (large)			(Not specified)
Wire nipper			(Not specified)
Needle nose pliers			(Not specified)
Diagonal pliers			(Not specified)
Soldering iron, stand			(Not specified)
Desoldering tool			(Not specified)
Wrench set			(Not specified)
Adjustable wrench			(Not specified)
Tweezers			(Not specified)
Hammer			(Not specified)
Wire (various types)			(Not specified)
Cutter			(Not specified)

Consumables list

Consumables	Type	Manufacturer	Specifications/standards
Insulation tape			(Not specified)
Hishilite tube, Empire tube (various types)			(Not specified)
Wiring material (various types)			(Not specified)
Screws, nuts, washers (various types)			(Not specified)
Solder			
Paper file (various types)			
Ethanol for cleaning and disinfection			

5.2 Maintenance Personnel

To ensure the performance and safety of the system, the maintenance personnel shall be technical professionals from Mindray or engineers who have been trained and have capability of maintenance for this system.

6

Checks

6.1 Equipment condition Inspection

6.1.1 Inspection Schedule

The inspection schedule for the first year after installation is shown below.

Model	Inspection Schedule		Remarks
	6 months after installation	12 months after installation	
DC-6/DC-6T	--	1	

6.1.2 Checks before inspection

6.1.2.1 Check the system conditions

Check the items below together with the user, thus confirming the system conditions. Check:

- 1) Any abnormality while the system is in operation;
- 2) Occasional abnormalities;
- 3) Other items requested by the user.

6.1.2.2 Check the operating environment

Check the temperature and humidity in the examination room. The measurements related to electric safety are particularly sensitive to the humidity. These measurements are also sensitive to the measuring location and measuring circuit.

If the insulation characteristics deteriorate due to the system changes over time or system malfunctions, the measurement fluctuations are likely to increase with the increase in humidity.

6.1.2.3 Check the system settings

Check the preset conditions of the system, brightness and contrast of the monitor, and optional devices (including the transducer).

6.1.2.4 Check the system version

Press the F10 key on the keyboard to enter the preset menu, select the system preset item to enter the system preset screen, and click the system information button to check the software

version.

6.1.2.5 Check the system operation

Check that the menus and windows can pop up normally.

Check that measurements can be performed in each exam mode, such as OB measurements and cardiac measurements, etc.

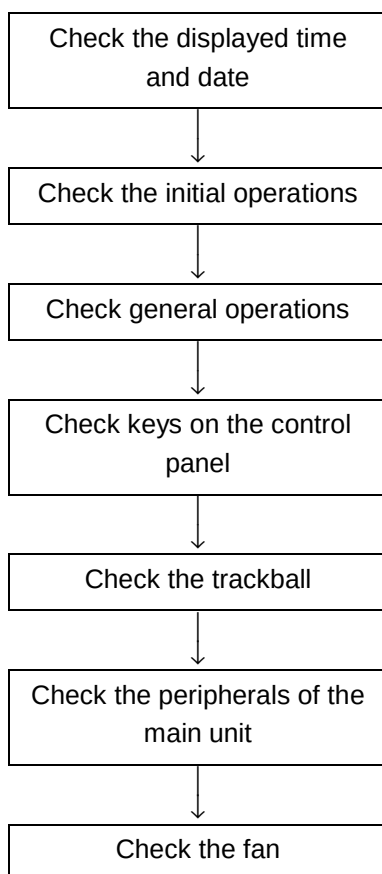
Check that exam modes can be normally switched.

Check that display modes can be normally switched.

Check that the transducers can be normally switched.

6.2 Function checks

6.2.1 Flowchart for function checks



6.2.2 Content of the function checks

- 1) Checking displayed time and date
 - Check that the displayed time and date are correct.
 - If not, correct them.

- 2) Checking the initial operations
 - Check the functions of each MODE key.
 - Check and print out the images obtained by every transducer.
 - Check the functions of the peripheral devices.
- 3) Checking general operations
 - Check that the Freeze key can freeze or unfreeze an image.
 - Check that the gain key can normally work.
 - Check that the Power, Color, PW, M and B modes can be normally switched.
- 4) Checking keys on the control panel
 - Check that the keys can normally work as per the order of left to right and up to down.
 - Check that the print key can normally work.
- 5) Checking the trackball
 - Pressing the Freeze key can enter the freeze status, and pressing the Measure key can enter the measurement status.
 - Measure the vertical distance and horizontal distance to confirm that the trackball can normally work.
- 6) Checking peripherals of the main unit
 - Check that the CD can normally eject.
 - Check that the breaker can be normally turned on or off.
 - Check that the transducer can be normally disconnected, and it can normally work after connected to the socket.
- 7) Checking the fan
 - Turn on the power of the main unit and check that the fan installed on it is running smoothly.
 - Check that the fan doesn't give abnormal sound when running.

6.3 Safety Checks

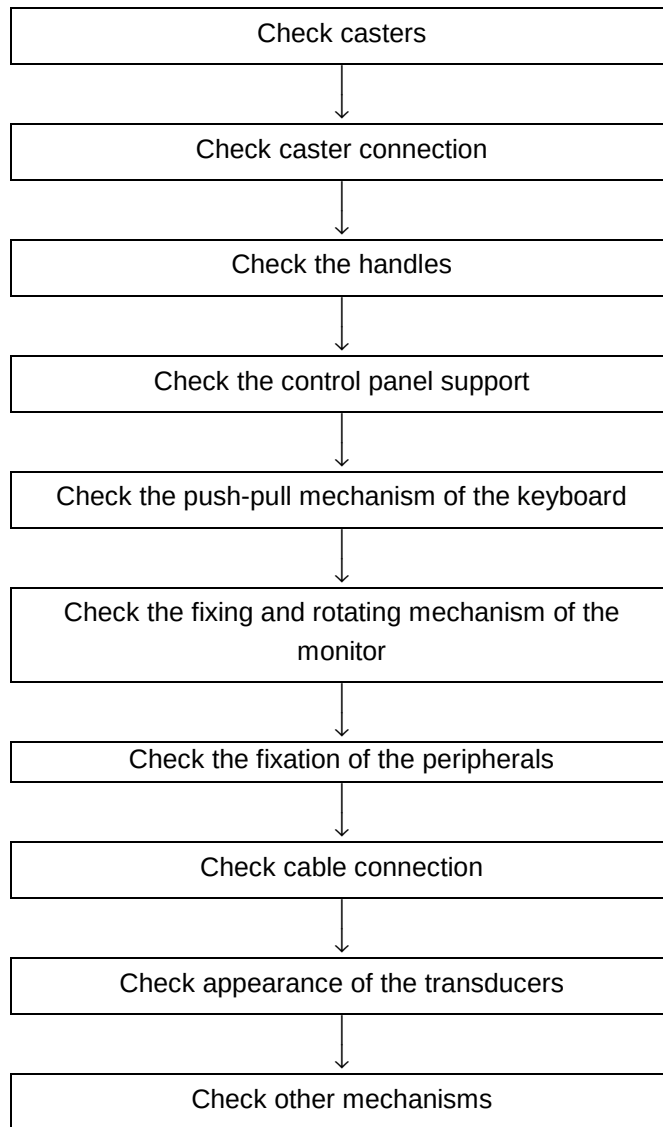
6.3.1 Electric safety

Refer to [Appendix D Electrical Safety Inspection](#).

6.3.2 Checks for mechanical safety

Evaluation: execute the evaluation by means of visual check and operating checks

- Flowchart for checks



If the check result cannot pass, it shows that the system is in the abnormal status. Now the system shall be stopped and adequate measures shall be taken.

item	check content	procedure	tool
Mechanical safety	casters	1) Check the casters by eyes to confirm that there is no crack. 2) Operate the casters to confirm that the locking and releasing functions are normal.	

item	check content	procedure	tool
Mechanical safety	Caster connection	1) Check the casters by eyes to confirm that there is no skewness, and the connecting screws are free of breakage or falling off. 2) Use a wrench to check that the connecting screws of the casters and the base are free of looseness.	Inner hexagonal wrench
	handles	1) Check the handles by eyes to confirm that the front and rear handles are free of crack. 2) Pull the rear handle by hand to confirm that the handle is free of looseness.	
	Control panel support	Pull the control panel by hand to confirm that the control panel is free of looseness. 1) Check the keyboard by eyes to confirm that its sliding tracks are free of deformation and crack. 2) Check that the push-pull function of the keyboard is normal.	
	Push-pull mechanism of the keyboard	3) Pull the keyboard to confirm that it is securely fixed on the sliding tracks, free of looseness. 4) Pull out the keyboard and check it by eyes, to confirm that the cable is free of looseness and scratch.	
	Fixing and rotating mechanism of the monitor	1) Check the monitor by eyes to confirm that it doesn't tilt. 2) Check by manual operation to confirm that the left/right and up/down rotation functions are normal, and there is no abnormal sound from rotation.	
		3) Pull the monitor leftward and rightward to confirm that there is no looseness.	

item	check content	procedure	tool
Mechanical safety	Fixation of the peripherals	4) Remove the rear cover of the control panel and neck cover of the monitor, check by a wrench to confirm that the fixing screws are free of looseness; check by eyes to confirm that the cables are free of scratch. Use the wrench to check and confirm that the peripherals are free of looseness.	Philips screwdriver, inner hexagonal wrench
	Cable connection	1) Check by eyes to confirm that the cables, inside or outside the system, are free of damage and scratch. 2) Check by hand to confirm that the cables inside the system are free of looseness and falling off.	Philips screwdriver
	Appearance of the transducers	Check by eyes to confirm that the transducers are free of crack, peeling, looseness or damage.	
	Other mechanisms	Check to confirm that other mechanisms are free of crack or exposure of conductive parts.	

6.4 Image Checks

6.4.1 B/W image phantom data checks and image records

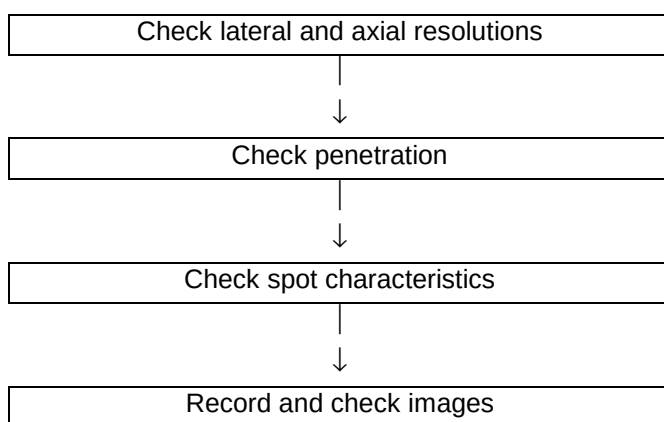
6.4.1.1 System setups

The user-defined setups are adopted for all the setups which aren't mentioned in this manual. For the setups changed due to special reasons, they shall be recorded as added information.

6.4.1.2 Image records and archives

The printed images shall be archived with the recorded data.

6.4.1.3 Flowchart for checks



Perform the above checks for all transducers used.

6.4.2 Check phantom data

6.4.2.1 Lateral/axial resolutions

1. Smear ultrasound gel on the phantom, and use the transducer to examine.
2. After a good-quality image is obtained, freeze and record the image.

Condition: system preset parameters

6.4.2.2 Penetration

- 1) Smear ultrasound gel on the phantom, and use the transducer to examine.
- 2) Adjust GAIN to make the spots of soft tissue displayed in the deepest position.
- 3) Measure the noise and the depth of the soft tissue boundary, and record the image for measuring the depth.

6.4.2.3 Spot characteristics

Evaluate the images for quality after the system has been used for a long period of time, including gain and periodically recorded images.

6.4.2.4 Recorded images

The printed images shall be archived as per the above description.

6.4.3 Final operation checks and image archive

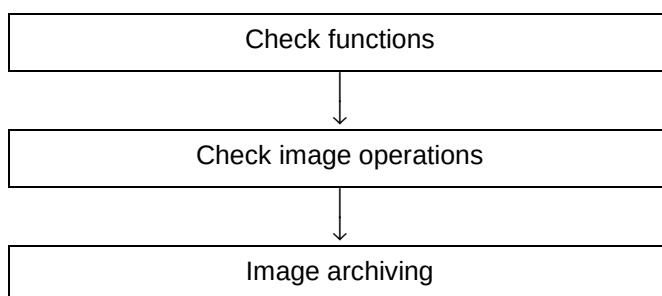
6.4.3.1 Image operation check

Check the image operations using each transducer in each mode.

6.4.3.2 Image printing and archiving

The printed images shall be archived with the recorded data.

6.4.3.3 Flowchart for checks



Perform the above checks for each transducer.

6.4.3.4 Check content

1) Checking functions

Check the mode change, measurements and relevant information.

2) Checking image operations

Perform image operations using each transducer in each mode.

3) Image archiving

Print the images and archive the images.

6.4.4 Checking color flow images

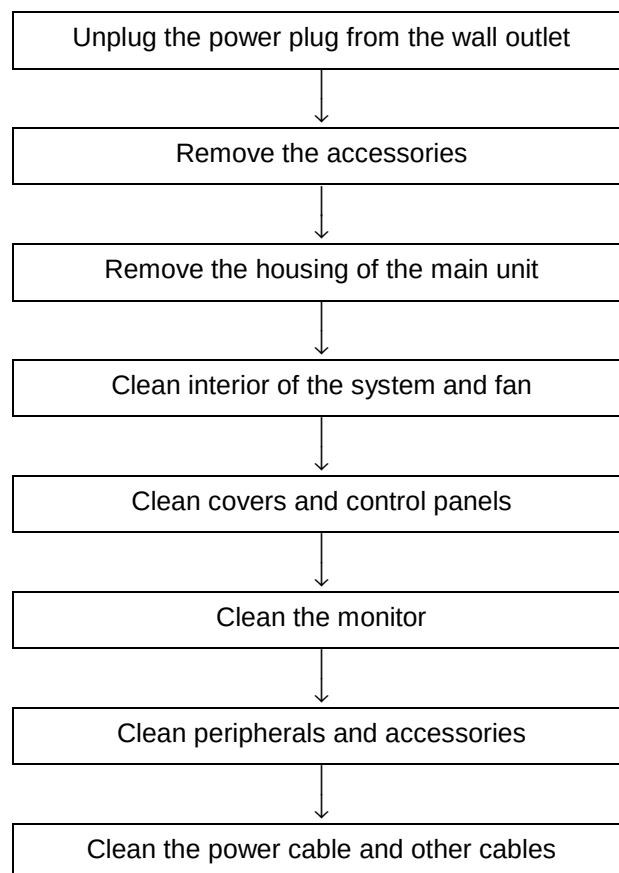
The service engineers shall be trained by Mindray's professionals, and the method is to use a transducer to examine and capture a color carotid flow image. The color flow image shall be evaluated depending on whether the flow is full, whether there is an artifact or overflow, and whether the edge is smooth.

7

System Maintenance

7.1 Cleaning

7.1.1 Flowchart for cleaning



7.1.2 Content of the cleaning

1) Interior of the system and fan

Unplug the power plug from the wall outlet.

Remove the accessories: transducer, transducer holder and printer, etc.

Remove the housing of the main unit and shielding covers and IO box, thus the internal PCBAs, power module and monitor assembly can be seen. If the PCBAs are normal, do not remove them.

Use a big plastic bag to cover the main unit.

Put the nozzle of the vacuum cleaner into the plastic bag, and turn on the vacuum cleaner to vacuum dust.

Cut an opening at the top of the plastic bag to insert the pipe of the blower. Then use the blower to clean the dust of the main unit.

Care shall be taken when the plastic bag is removed, to avoid the dust from leaking out of the bag.

Vacuum all remaining dust with the vacuum cleaner.

2) Covers and control panels

Wipe off any dirt on the main unit covers and control panels using neutral detergent. If it is difficult to clean the control panels, remove the switch covers first and then wash off the dirt using neutral detergent.

3) Monitor

Check that the monitor is not skew and fixing mechanism is secured.

4) Transducer

Wipe off any dirt from the transducer, check it for abnormalities such as cracks, and then connect it to the main unit. Wash the transducer holder with a soft brush to remove dirt.

5) Video printer

Clean the thermal head according to the operation manual for each printer.

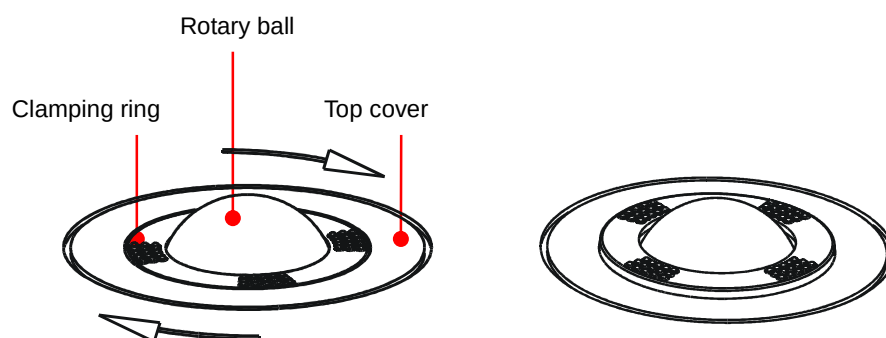
6) Power cable and other cables

Wipe off any dirt from the main unit power cable and the signal cables using neutral detergent.

7) Cleaning the trackball

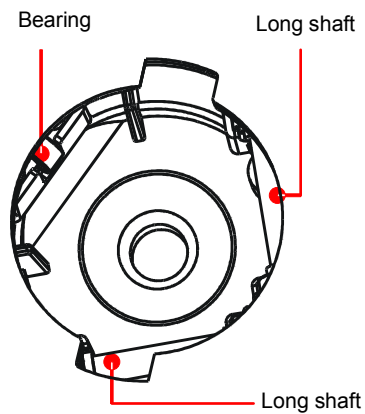
a) Disassembling the trackball

Press the bulges on the clamping ring by both hands and turn the ring about 45° clockwise until it lifts. Take out the ring and the rotary ball. Be careful not to drop the ball.



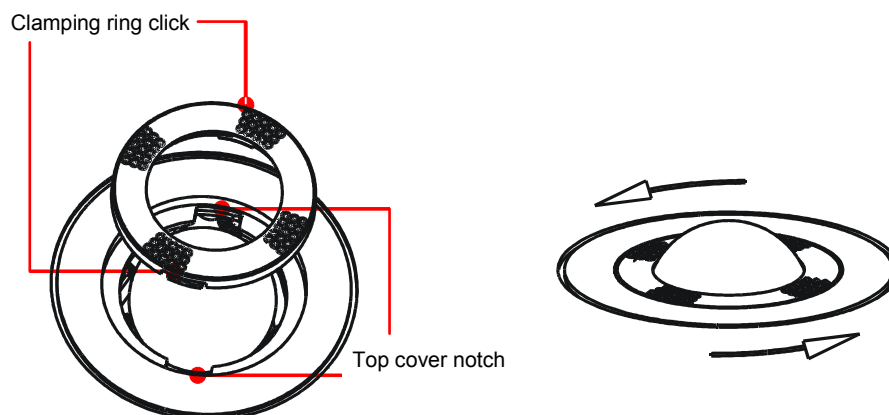
b) Cleaning the trackball

Clean the two long shafts, the bearing and the rotary ball with clean soft dry cloth or paper.



c) Installing the trackball

Put the rotary ball back in the trackball and then align the clamping ring click with the top cover notch. Press the bulges on the ring with both hands and turn the ring about 45° counterclockwise until the ring clicks. As the bulges are flush with the top cover, the ring is secured.



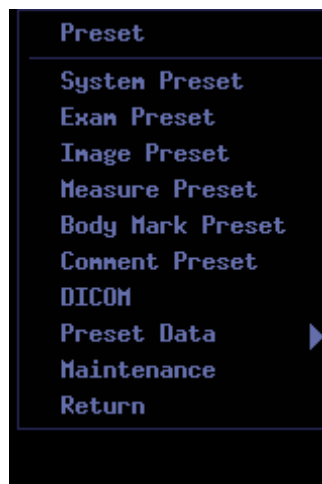
7.2 Software Maintenance

Note: If power is off during upgrading process, the upgrading operation will fail and the system cannot be reset.

7.2.1 Back up the preset data

Prior to software maintenance, confirm that all relevant data must be those used in this system; otherwise it may result in system damage. At the same time, the user shall back up the preset data as per the procedures below.

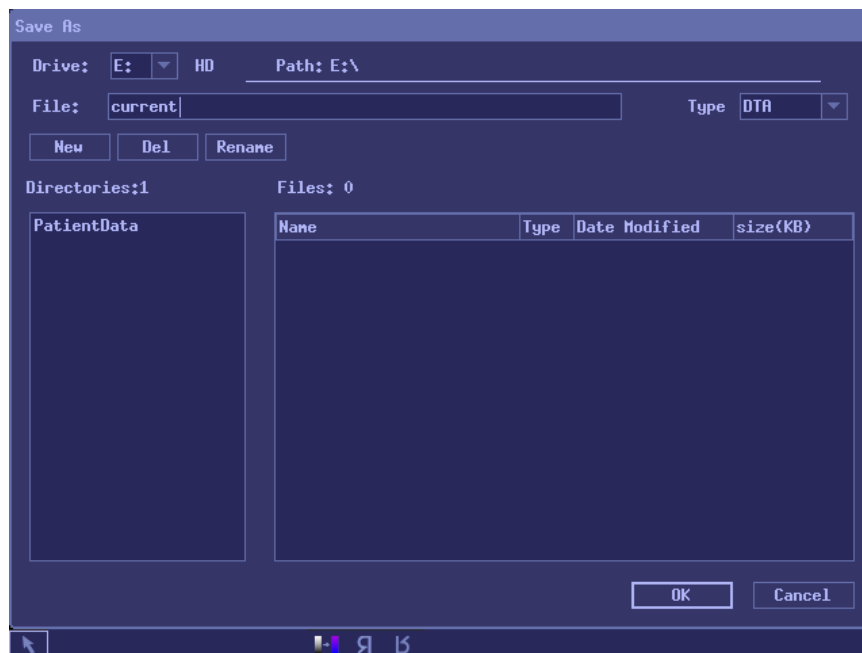
1. Press the F10 key on the keyboard to enter the preset menu, as shown in the figure below:



2. Move the cursor onto "Preset Data", and select "Save", as shown in the figure below:



3. After the Set key is pressed, a dialog box appears; select the storage path and enter a filename, as shown in the figure below:

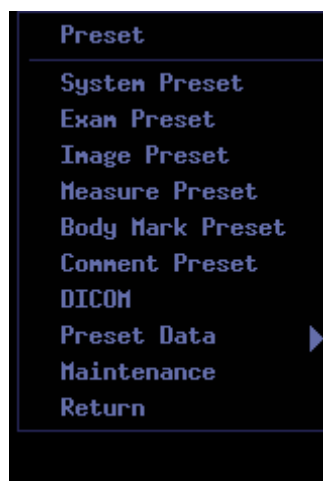


4. Click the OK button, and the backup of preset data is completed.

7.2.2 Restore the preset data

After the software maintenance is completed, the user must restore the preset data as per the procedures below.

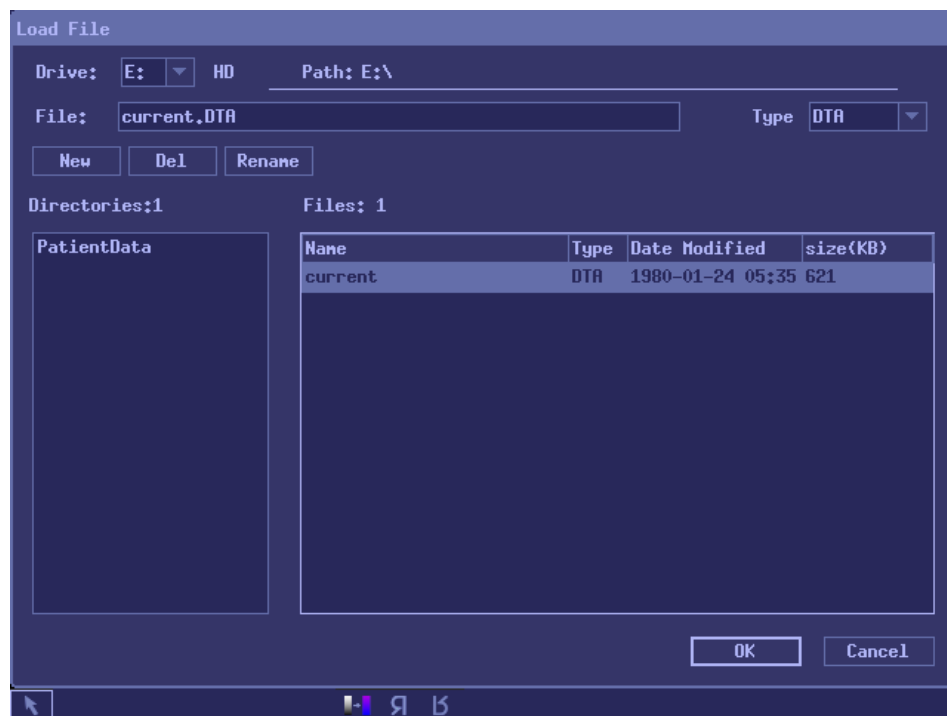
1. Press the F10 key on the keyboard to enter the preset menu, as shown in the figure below:



2. Move the cursor onto "Preset Data", and select "Load", as shown in the figure below:



3. After the Set key is pressed, a dialog box appears; select storage path and file, as shown in the figure below:



4. Click the OK button, and the loading of preset data is completed.

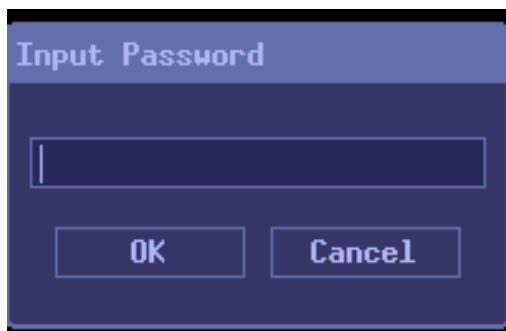
7.2.3 Upgrade the software

7.2.3.1 Upgrade files in batches

1. Enter the preset menu via F10 on the keyboard, as shown below:



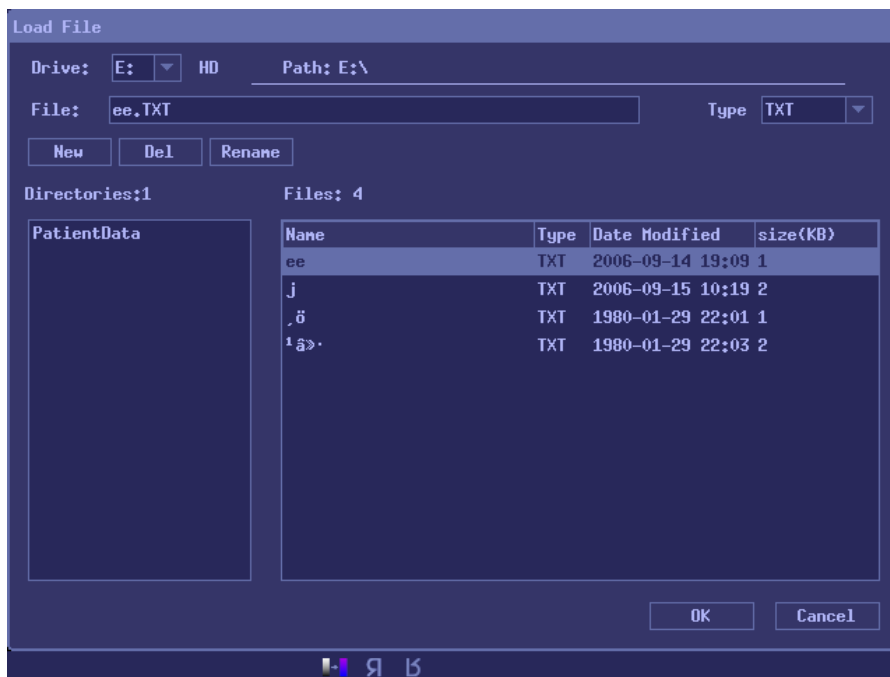
2. Select Maintenance and press the Set key; after the dialog box below appears, enter the password.



3. Press OK to enter the Maintenance menu, as shown below:



4. Select Update and press the Set key to enter the dialog box shown below, and then select the files with suffix TXT in the upgrading file folders on the corresponding driver.



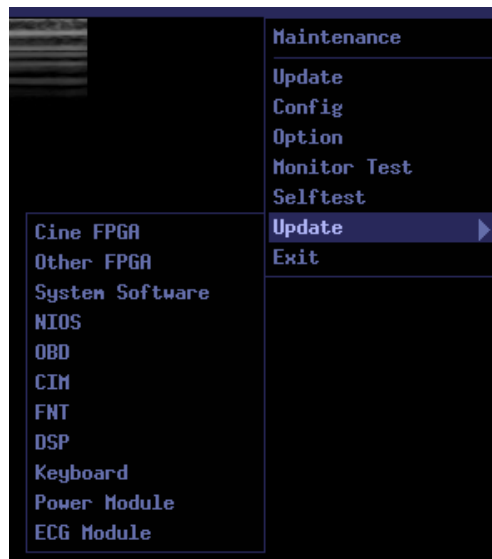
5. Select OK and press the Set key, and then the system starts to upgrade files in batches.
6. After the system prompts "The upgrade is complete, please turn it off and restart it to make the upgraded files effective", the system finishes the upgrade and shuts down and then restarts.

7.2.3.2 Upgrade files one by one

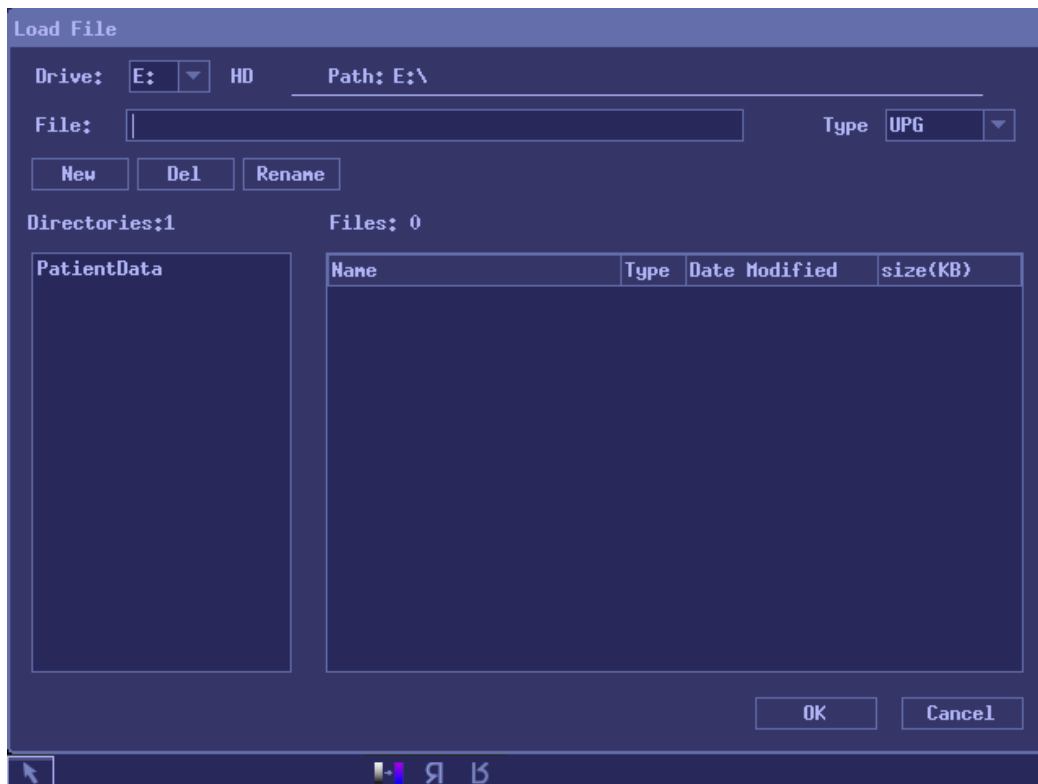
1. Enter the Maintenance menu as per section 7.2.3.1; press Shift+F8, and then the menu item for upgrading files one by one appears, as shown below:



2. Move the cursor on the Upgrade item, as shown in the figure below:



3. Select the system software item and press the Set button, as shown in the figure below:



4. In the upgraded file folder of the corresponding drive (the corresponding drive of the U disk is G:) , select the files with suffix UPG, and then select OK and press the Set key. The system starts to upgrade the system software. After the upgrading is completed, the following dialog box appears:



5. Move the cursor on OK and press the Set key, and the system will upgrade other files in the upgrading package as per the above procedures. After the upgrading of other files is completed, the system shall be restarted.

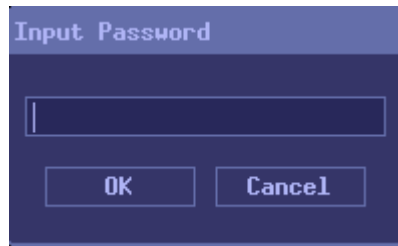
Note: only after the upgrading of all files is completed, will the system be restarted; otherwise the system may not be initialized.

7.2.4 System recovery

When the system doesn't respond to any operation or cannot be started, please recover the system according to the following procedures:

1. Copy the system recovery data and configuration files package to the U disk.
2. Turn off the machine, insert the U disk to the USB port, and connect the recovery dog (2105-20-40622) to the parallel port.
3. Turn on the machine, and the system will automatically enter recovery. The following message pops up, stating: "Notify: Rescue is successful, please eject rescue disks & dog and then restart. This indicates that the system is recovered successfully. Then restart the system."

4. Follow the steps 1 through 3 in section 7.2.3.1 to enter the maintenance menu and select Config and press Set. The Input Password dialog box appears.



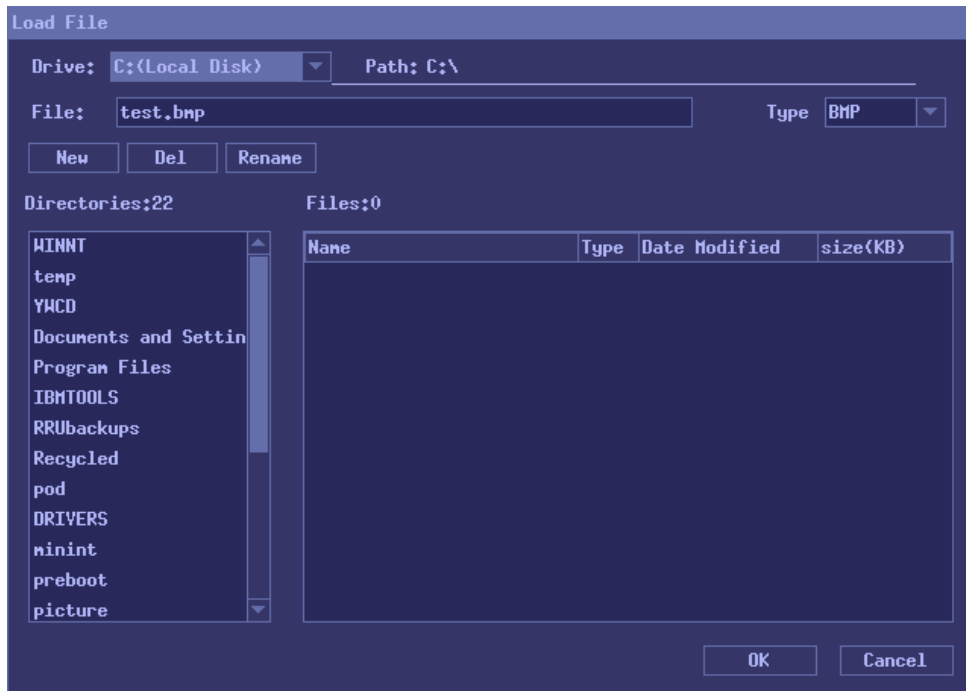
The 'Input Password' dialog box is a small window with a title bar. It contains a single-line text input field. Below the input field are two buttons: 'OK' and 'Cancel'.

5. Input correct password and press OK to enter the configuration screen.



The 'Config' dialog box is a larger window with a title bar. It contains a 'Config' tab. Inside the tab, there are two text input fields: 'Product Model' with the value 'DC-6' and 'Law Type' with the value 'DC-6'. Below these fields is a checked checkbox labeled 'Manufacturer Logo'. To the right of the checkbox are three buttons: 'Load Product Symbol', 'Load Boot Logo', and 'Load Dormancy Image'. At the bottom of the dialog box are two buttons: 'OK' and 'Cancel'.

6. Click the Load Product Symbol button, and the following dialog box appears.



7. Select the corresponding file in the C:\Picture\logo, and click OK.
8. On the Config screen, respectively click the Load Boot Logo and Load Dormancy Image to set the corresponding images.

Note: Refer to Appendix C for Initial Data of the Hard Disk.

9. Press F10 on the keyboard to enter the preset menu, move the cursor onto "Preset Data" and its submenu pops up, select "Default" and press the Set key to recover the factory setups.

7.2.5 Hard disk recovery

If the hard disk is damaged or the system data is damaged, please perform the following operations to recover.

Note: You must confirm that the data of the hard disk recovery package are compatible with the current software system; otherwise it may damage the system.

1. If the hard disk is damaged, replace it with a new one. Please format the new hard disk according to the FAT32 format. Partitions are shown as follows:

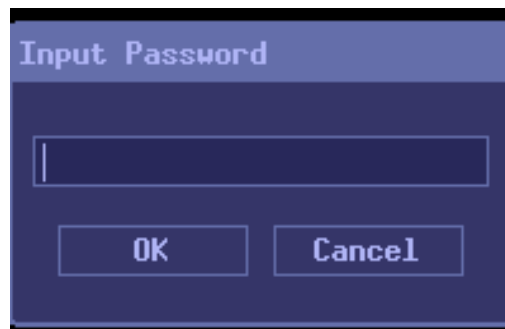
Hard Disk	C disk	D disk	E disk
40G	10G	20G	9G
80G	19G	27G	27G

2. Copy the data of the hard disk recovery and files of the configuration files package to the U disk
3. Turn off the machine, insert the U disk to the USB port, and connect the recovery dog (2105-20-40622) to the parallel port.

4. Turn on the machine, and the system will automatically enter recovery. The following message pops up, stating: "Notify: Rescue is successful, please eject rescue disks & dog and then restart. This indicates that the hard disk is recovered successfully. Then restart the system.
5. Recover the factory setups according to step 9 in the section 7.2.4.

7.2.6 Install and uninstall the software of optional devices

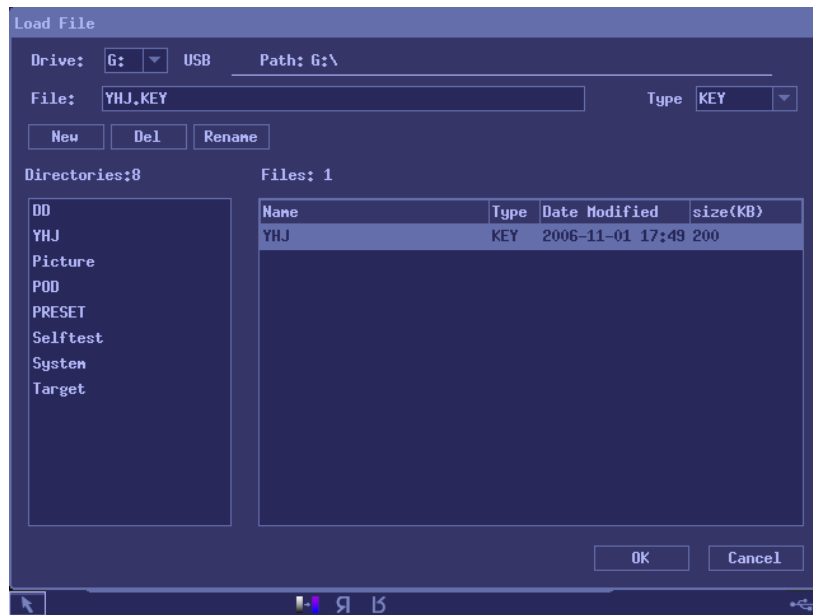
1. Enter the Maintenance menu as per section 7.2.3.1 and click the option item, and the Input Password dialog box appears, as shown in the figure below:



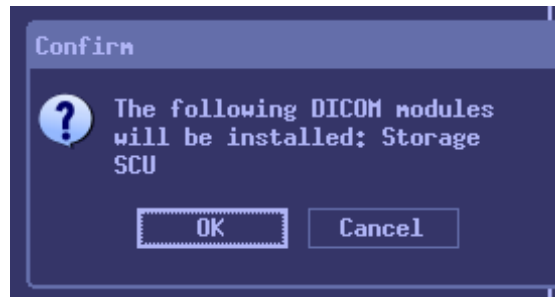
2. After the password is entered and the OK button is clicked, a dialog box appears, as shown in the figure below:



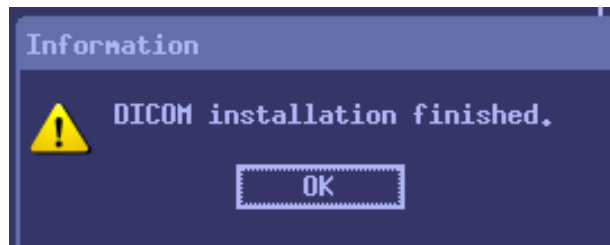
3. Install the DICOM
 - a) In the dialog box, select the Install DICOM button and press the Set button, and select the files with suffix "key" under the directory of the corresponding drive; the following dialog box appears.



- b) Click OK button, and the following dialog box appears.



- c) Click OK button, and the following dialog box appears.



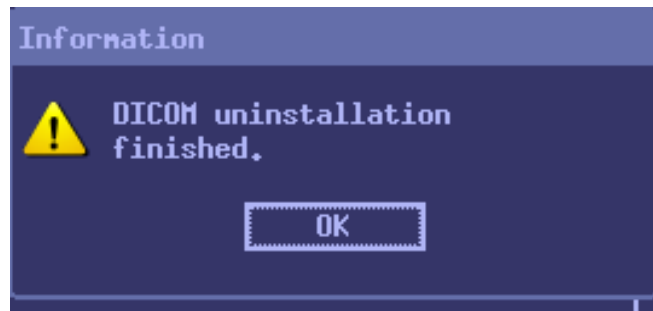
- d) Click OK button, and the installation of DICOM is completed.

4. Uninstall the DICOM

- e) In the dialog box for installing and uninstalling the software, select the Uninstall DICOM button and press the Set button, and the following dialog box appears.



- f) Click OK button, and the following dialog box appears.

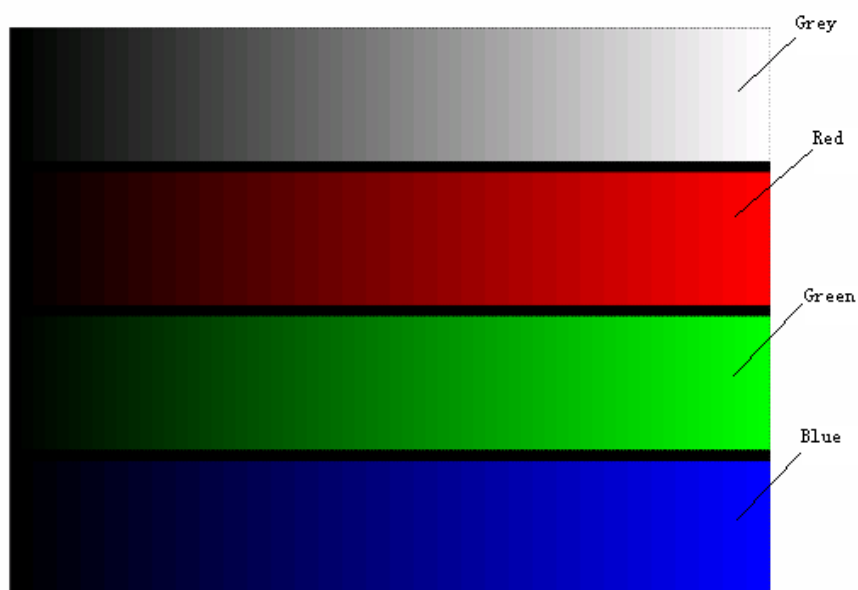


- g) Click OK button, and the DICOM uninstall is completed.
5. Install and uninstall the HPRF, "Smart3D", "iScape" and "Free Xros M"
- h) In the dialog box for installing and uninstalling the software, select Install and the corresponding function button and press the Set key, and apply correct KEY file to install the corresponding function software.
- i) In the dialog box for installing and uninstalling the software, select Uninstall and corresponding function button and press the Set key to uninstall the function software.

Note: to install the function software, you must use the KEY file which is corresponded to the system.

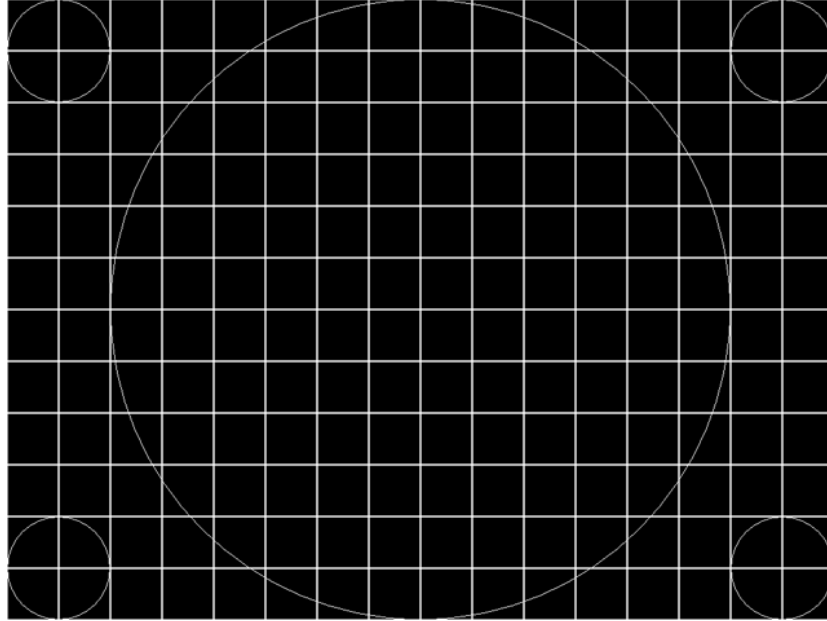
7.2.7 Monitor test

1. Enter the Maintenance menu as per section 7.2.3.1 and select the monitor test item and press the Set button to enter the monitor test.



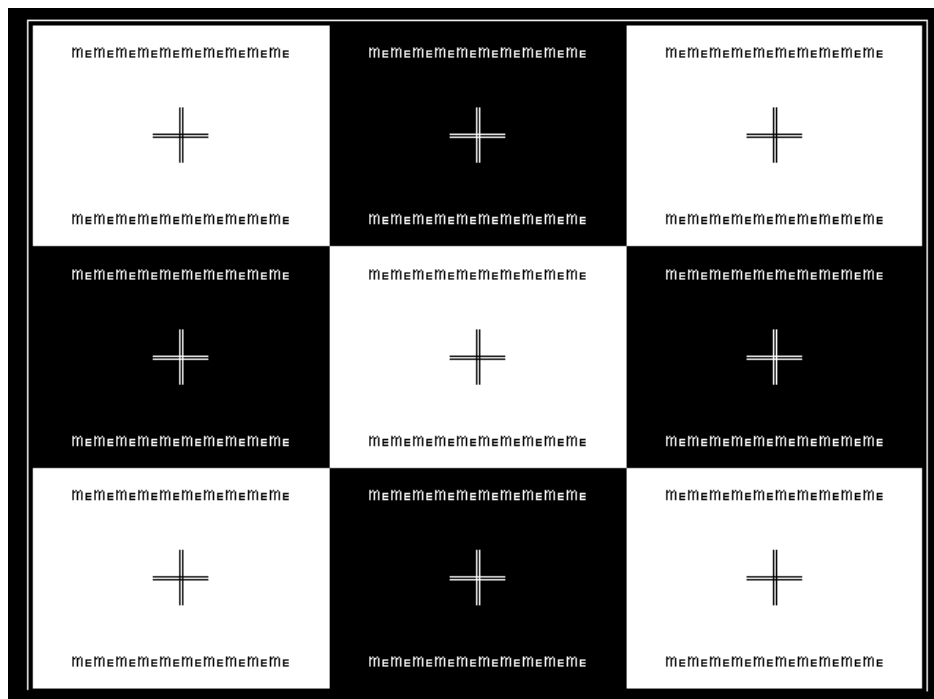
The evaluating criterion is shown as follows:

- 1) The monitor shall display the four colors as shown in the figure above.
 - 2) The brightness turns brighter from left to right.
2. After the left arrow key on the lower right part of the keyboard is pressed, and the monitor displays as follows:



The evaluating criterion is: the circles and squares displayed on the monitor shall be the same as those in the figure, and no distortion is allowed.

3. After the right arrow key on the lower right part of the keyboard is pressed, and the monitor displays as follows:



The evaluating criterion is: the characters and crosses displayed on the monitor shall be the same as those in the figure, which are clearly recognizable.

4. For LCD monitor, you shall perform the test of bright points and dark points.

The evaluating criterion is shown as follows:

The number of bright points is 0;

The number of continuous dark point pair is less than or equal to 3 pairs, and no continuous dark point appears in the image area;

There are no three or more than three continuous dark points;

The sum of dark point defects is less than or equal to 7, and the number of dark points in the image area is less than or equal to 2;

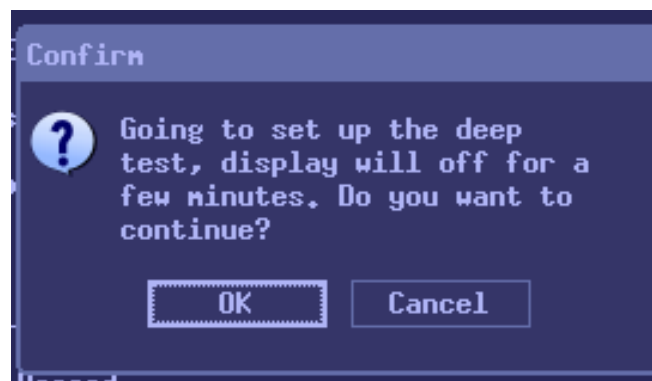
The number of point flash defects is 0;

Space between failpoints is greater than 5mm.

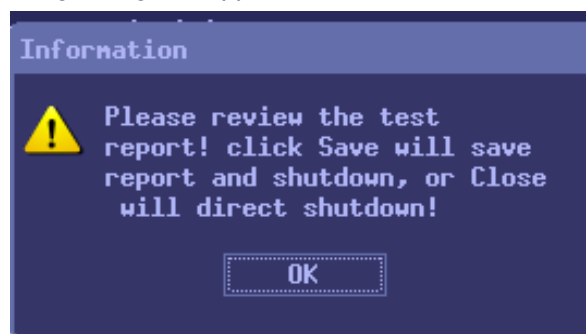
5. Press the Exit key to exit the monitor test.

7.2.8 Self-test

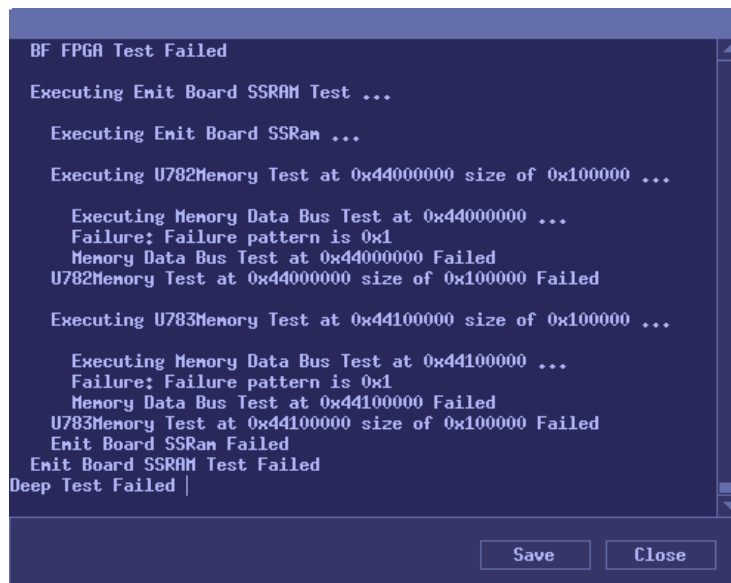
1. Enter the Maintenance menu as per steps 1, 2 and 3 in the section 7.2.3.1, select the Selftest item and press Set to enter the system self-test.
2. Wait until the following dialog box appears, and click OK button to enter the depth test.



3. Wait until the following dialog box appears.



4. Click OK button, and the dialog box of self-diagnosis report appears.



5. Press the Save button to save the self-diagnosis report in the directory of D: \log; if press the Cancel button, the system will not save the self-diagnosis report. The follow dialog box appears.



6. Restart the system.

8

Troubleshooting

8.1 Troubleshooting for Power

No.	problem	possible reason	measure
1	When the circuit breaker is turned on, it trips.	The voltage range is incorrect or the primary side is connected inversely.	1. Check if the voltage is correct. 2. Check if the connection wire of the transformer is correctly connected.
2	When the circuit breaker is turned on, the standby indicator isn't on.	Due to fault of the input connection wires or the PFC board.	1. Check if the connection wires are correctly connected. 2. Replace the PFC board.
3	When the power switch is turned on, the power system doesn't work (The keyboard backlights aren't on)	Due to fault of switch connection wire or the PFC board/+5V board.	1. Check the switch connection wire. 2. Replace the PFC board/+5V board.
4	The power can normally work, but the monitor power indicator isn't on.	Due to fault of the power cable of the monitor or the connecting board.	1. Check the connection wire of the monitor. 2. Replace the connecting board.
5	The keyboard backlights are on, but the fan doesn't run.	Due to fault of the fan connection wire or the -5V board.	1. Replace the -5V board. 2. Check the fan adapter board and connection wire.
6	The image is abnormal and there is no transmission.	Due to fault of the PHV board or the -5V board.	1. Replace the PHV board. 2. Replace the -5V board.

8.2 Troubleshooting for Monitor

Note: if the monitor cannot display, first check the contrast and brightness and adjust them to the middle positions. If the monitor is still abnormal, use the following table to locate problems.

No.	problem	possible reason	measure
1	There is no display on the monitor. The monitor indicator isn't on.	Due to fault of the monitor power.	Check the power cable.
2	There is no display on the monitor. The monitor indicator is in yellow color.	Due to fault of the monitor signal.	1. Check the signal cable. 2. Check connection of the IO BOX.
3	There is no display on the monitor. The monitor indicator is in green color.	Due to fault of setup or DSP board.	1. Check the contrast and brightness knobs. 2. Replace the DSP board.
4	The image is abnormal.	Due to fault of the monitor signal.	Check the signal cable.
5	The screen flickers.	Due to fault of the monitor signal or CRT.	1. Check the signal cable. 2. Replace CRT.

8.3 Troubleshooting for the Power-up Process

No.	problem	possible reason	measure
1	The power-up graphic isn't displayed, and there is no response from the system.	1. Due to fault of the DSP board. 2. Due to fault of the IOBOX.	1. Replace the DSP board. 2. Replace IOBOX.
2	After the power-up graphic is displayed, there is no response from the system.	1. Due to fault of hard disk drive. 2. Due to fault of the DSP board.	1. Check the HDD cable, and remove the HDD to rewrite data. 2. Replace the DSP board.
3	After the menu is normally displayed, there is no response from the system.	1. Due to fault of the boards.	1. Replace the boards in the order of DSP, beamformer, and transmission boards.
4	After the menu is normally displayed, the system prompts the error of transducer ID recognition.	1. Due to damage of the transducer's FLASH. 2. Due to the HDD without corresponding transducer data.	1. Replace the transducer. 2. Copy transducer data to the HDD.

8.4 Troubleshooting for the Operation Process

No.	problem	possible reason	measure
1	There are minute dark stripes in the near field.	1. Due to fault of the transducer. 2. Due to fault of the transmission circuit.	1. Replace the transducer. 2. Replace the transmission board.
2	There are evident and symmetrical dark areas in the near field.	1. Due to fault of ADC. 2. Due to fault of amplifier.	1. Replace the beamformer board. 2. Replace the amplifier board.
3	There are asymmetrical dark areas in the near field.	1. Due to fault of the transmission board. 2. Due to fault of the transducer board.	1. Replace the transmission board. 2. Replace the transducer board.
4	The image is displayed with evident stripes, flickers, bright spots or dark spots.	1. Due to fault of the digital circuit.	1. Execute self-diagnosis, and replace the corresponding board as per error prompts. 2. If there is no error prompt, replace boards in the order of the beamformer board and the DSP board.

8.5 Troubleshooting for Software

No.	problem	possible reason	measure
1	The HDD cannot be recognized, since the HDD indicator is always on or off during start-up process, rather than flickers.	1. Due to CD drive, the HDD is affected. 2. Due to the HDD fault.	1. Disconnect the CD cable of the IO box. 2. Replace the HDD.
2	During the power-up process, if the process bar stops for a long time (over 10s), the system cannot normally be entered.	1. Due to fault of the HDD or CD drive. 2. Due to error of HDD preset data; especially if the preset data is recently changed. 3. Due to damage of other data than preset data of HDD.	1. Refer to the first point above. 2. Change the "preset" directory of C disk to another name or directly delete it (Doing this can make the previously preset data disabled, but can restore the factory setups.) 3. Restore the system so as to restore the factory setups.

No.	problem	possible reason	measure
3	After a U disk or USB portable HDD is connected, the icon doesn't appear at the lower right corner of the screen, thus the U disk or HDD cannot be used.	1. The model of the U disk or HDD isn't supported by the system. 2. The file format of the U disk is neither FAT nor FAT32. 3. For the portable HDD, it may be due to insufficient power supply.	1. The recommended models shall be used. 2. Under the Windows, format the file to FAT or FAT32. 3. External power supply shall be used.
4	The graph/text printer cannot print reports normally.	1. The print model isn't supported by the system. 2. Fault of the printer occurs.	1. The supported models shall be used. 2. Under Windows, print a report to confirm that the printer can normally work.

8.6 Troubleshooting for Others

No.	problem	possible reason	measure
1	The fan cannot run.	1. fault of +12V power 2. fault of the cable 3. fault of the fan	1. Check the +12V power. 2. Replace the cable. 3. Replace the fan.
2	An error of the reset switch occurs.	1. Due to bad contact of the reset switch. 2. Fault of the cable.	1. Check the ON/OFF situation. 2. Replace the cable.
3	An error of Ethernet connection occurs.	1. Fault of the Ethernet cable. 2. Abnormality of the Ethernet transformer. 3. Fault of the DSP board.	1. Replace the Ethernet cable. 2. Replace IOBOX. 3. Replace the DSP board.
4	An error of video input/output occurs.	1. Inadequate connection of connection of the video cable. 2. Abnormality of the IOBOX. 3. Due to fault of the DSP board.	1. Check the cable. 2. Replace the IOBOX. 3. Replace the DSP board.

No.	problem	possible reason	measure
5	There is no response from the main panel.	1. Fault of the software. 2. Fault of the power cable of the main panel. 3. Fault of the serial port cable of the main panel. 4. Fault of the main panel.	1. Restart the system. 2. Replace the power cable of the main panel. 3. Replace the serial port cable of the main panel. 4. Replace the main panel.
6	There is no response from the trackball.	1. Fault of the software. 2. Fault of the cable of the trackball. 3. Fault of the trackball.	1. Restart the system. 2. Replace the cable of the trackball. 3. Replace the trackball
7	There is no response from the keyboard.	1. Fault of the software. 2. Fault of the cable of the keyboard. 3. Fault of the keyboard.	1. Restart the system. 2. Replace the cable of the keyboard. 3. Replace the keyboard
8	The light for the keyboard isn't bright or cannot be turned off.	1. Fault of the cable of the light for the keyboard. 2. Fault of the travel switch. 3. Fault of the control board of the light.	1. Replace the cable of the light for the keyboard. 2. Replace the travel switch. 3. Replace the control board of the light.

Appendix A Spare Part List

No	Part Number	Part Name	Quantity	Parent module
1.	2105-30-40101	+5V board	1	Power main unit box assembly (2105-30-40363)
2.	2105-30-40108	-5V power board	1	
3.	2105-30-40114	PHV power board	1	
4.	2105-30-40095	PFC board	1	
5.	2105-30-40433	Power output monitor board	1	
6.	2105-30-40365	Power outlet fan assembly	1	
7.	2105-30-40364	Power inlet fan assembly	1	
8.	2105-30-40122	Power motherboard	1	
9.	2105-20-40402	Cable between -5V board and +5V board	1	
10.	2105-20-40403	Cable between PFC board and +5V board	1	
11.	2105-20-40307	AC input cable of the power motherboard	1	
12.	2105-20-40308	12V cable of power motherboard to output board	1	
13.	2105-20-40309	3.3V cable of power motherboard to output board	1	
14.	2105-20-40310	5V cable of power motherboard to output board	1	
15.	2105-20-40311	High-voltage cable of power motherboard to output board	1	
16.	2105-30-40071	Digital signal processing board	1	System main unit housing assembly (2105-30-40367)
17.	2105-20-40064	Beamformer board.	1	
18.	2105-30-40067	Transmission board.	1	
19.	2105-30-40069	Amplifier board.	1	
20.	2105-30-40079	Transducer connecting board	1	
21.	2105-30-40089	System motherboard	1	
22.	2105-30-40368	System inlet fan assembly	1	
23.	2105-30-40369	System outlet fan assembly	1	
24.	2105-30-40081	IO interface board	1	System IO assembly (2105-30-40371)
25.	2105-30-40087	IO adapter board	1	
26.	2105-30-40091	IO connecting board	1	
27.	2105-20-40294	HDD power cable	1	
28.	2105-20-40295	HDD signal cable	1	
29.	2105-30-40592	HDD assembly (on-line download)	1	
30.	0000-10-10956	CD-RW 52x/32x/52x EACRX230AE-S	1	CD-ROM module (2105-30-40375)
31.	2105-30-40075	Main panel	1	Main panel assembly (2105-30-40385)
32.	2105-30-40303	Encoder control board PCBA	1	

No	Part Number	Part Name	Quantity	Parent module
33.	2105-30-40594	Mindray-made trackball assembly	1	
34.	2105-20-40347	Encoder cable	1	
35.	2105-20-40350	Cable of the light for the keyboard	1	
36.	2105-20-40353	Cable of functional encoder	2	
37.	2105-20-40354	Cable of Angel encoder	1	
38.	2105-30-40301	Minor panel PCBA	1	Minor panel assembly (2105-30-40386)
39.	2105-30-40344	Front output board	1	
40.	2105-20-40345	Minor panel signal cable	1	
41.	2105-20-40346	Cable of minor panel indicators	1	
42.	2105-20-40354	Cable of Angel encoder	2	
43.	2105-30-40393	Monitor assembly	1	Main unit with CRT monitor (2105-30-40372)
44.	2105-30-40387	Keyboard assembly	1	
45.	2105-30-40370	Transducer assembly	1	
46.	2105-20-40281	Cable bundle of I/O interface board	1	
47.	2105-20-40282	Signal cable of CD-RW module	1	
48.	2105-20-40284	Cable of VCR module	1	
49.	2105-20-40314	Power cable 1 of output board to system motherboard	1	
50.	2105-20-40317	Power cable 2 of output board to system motherboard	1	
51.	2105-20-40319	Cable of system motherboard to ECG and footswitch	1	
52.	2105-20-40320	Cable bundle of system motherboard to front output board	1	
53.	2105-20-40322	Cable of system motherboard to power monitor board	1	
54.	2105-20-40349	SP/2 cable	1	
55.	2105-20-40355	VCR power cable	1	
56.	2105-20-40357	Monitor power cable	1	
57.	2105-20-40412	Serial port cable of VCR module	1	
58.	TSB1-20-20511	Cable of peripheral power	1	Main unit with LCD monitor (2111-30-73274)(only different items from above are listed here)
59.	2111-30-73326	Support arm assembly		
60.	2111-30-73333	Monitor assembly		Main unit housing assembly (2105-30-40366)
61.	2105-20-40120	R1000 isolation transformer	1	
62.	M6L-010001---	caster.125mm white medical flat plate	4	Keyboard support
63.	2105-21-40351	Cable of travel switch	1	

No	Part Number	Part Name	Quantity	Parent module
64.	2105-30-40305	Keyboard light control board PCBA	1	assembly (2105-30-40388)
65.	M07-00100S---	SWITCH breaker 250V 13A	1	Power input assembly (2105-30-40382)
66.	2105-30-40119	Connecting board	1	
67.	2105-20-40286	Connection cable 1 of transformer	1	
68.	2105-20-40287	Connection cable 2 of transformer	1	
69.	2105-20-40291	AC input cable of connecting board	1	
70.	2105-20-40313	Output cable of connecting board to main unit	1	
71.	2105-20-40315	Ground line of line power supply	1	
72.	2105-20-40318	Cable of line power input socket to breaker	1	
73.	2105-21-40406	Cable of connecting board to auxiliary output	1	Monitor front cover assembly (2105-30-40390) optional
74.	2105-20-40293	Speaker and cable	2	
75.	2105-30-40389	Bottom light assembly	1	
76.	2105-30-40077	CW board	1	
77.	2111-30-73343	Built-in PC module	1	

Appendix B Interface Definition and Function List

B.1 System Motherboard

B.1.1 Definition of P7 interface between power output board connected to system motherboard

Pin	Definition	Pin	Definition
1	GND	21	GND
2	GND	22	GND
3	+VH1	23	A-100
4	GND	24	GND
5	GND	25	GND
6	GND	26	GND
7	-VH1	27	5V2
8	GND	28	SW1
9	GND	29	GND
10	GND	30	GND
11	+VH2	31	PW-LED
12	GND	32	GND
13	GND	33	GND
14	GND	34	GND
15	-VH2	35	NPW-OFF
16	GND	36	GND
17	GND	37	GND
18	GND	38	NPW-EN
19	A+100	39	GND
20	GND	40	GND

B.1.2 Definition of P8 interface between power output board connected to system motherboard

Pin	Definition	Pin	Definition
1	GND	11	GND
2	3.3V	12	3.3V
3	GND	13	GND
4	D+12V	14	GND
5	D+12V	15	D+12V
6	GND	16	F+12V

Pin	Definition	Pin	Definition
7	-12V	17	GND
8	GND	18	GND
9	GND	19	-5V
10	A+12V	20	GND

B.1.3 Definition of P9 interface between power output board connected to system motherboard

Pin	Definition	Pin	Definition
1	D+5V	8	D+5V
2	GND	9	GND
3	D+5V	10	D+5V
4	GND	11	GND
5	GND	12	3.3V
6	3.3V	13	GND
7	GND	14	3.3V

B.1.4 Definition of P10 interface between power output board connected to system motherboard

Pin	Definition	Pin	Definition
1	GND	7	A+5V
2	GND	8	GND
3	A+5V	9	A+5V
4	GND	10	GND
5	GND	11	GND
6	D+5V	12	D+5V

B.1.5 Functions of other interfaces in system motherboard

No	Interface	Function
1	P11	PC module
2	P12	Soft switch
3	P13	Power monitor board
4	P14	ECG module
5	P15	Front output board
6	P16	Front output board
7	P17	Reserved for future use
8	P18	Lower fan
9	P19	Upper fan

B.2 Interface definition and function of IO connecting board

Interface	Pin	Definition	Interface	Pin	Definition	Interface
J1 HDD power	1	D+5V	J9 reserved for HDD cooling fan power	1	D+12V	J2 HDD cables
	2	GND		2	D+12V	
	3	D+12V		3	GND	
	4	GND		4	GND	

B.3 Interface definition of IO interface board

Interface	Pin	Definition
J1 CD power interface	1	D5V
	2	D5V
	3	GND
	4	GND
	5	D12V
	6	D12V
	7	GND
	8	GND
J22 keyboard power interface	1	D5V
	2	D5V
	3	GND
	4	GND
	5	D12V
	6	D12V
	7	GND
	8	GND
J11 reserved for 8.4" LCD power interface	1	GND
	2	GND
	3	D12V
	4	D12V

B.4 Interface function of IO interface board

No	Interface	Function
1	J20	VCR/DVD control interface
2	J17	Monitor signal interface
3	J13	VCR video and audio input and output signal
4	J14	speaker
5	J31	B/W printer

No	Interface	Function
6	J6	Reserved for 8.4" touchscreen module VGA signal
7	J16	Touchscreen and keyboard control signal
8	J12	Reserved interface
9	J15	CD signal interface
10	J34	Reserved interface

B.5 Power input connecting board

Interface				Interface definition of P4 main unit power			
P1 AC power input interface	P2 transformer primary interface	P3 transformer secondary interface	P5/P6 AC auxiliary output interface	Pin	Definition	Pin	Definition
				1	AC_1	5	AC_2
				2	AC_1	6	AC_2
				3	NC	7	NC
				4	RY+	8	VPP

B.6 Definition of power indicators

The numbers of the power indicators are shown in the sequence from left to right:

No.	1	2	3	4	5	6	7	8	9	10	11	12
Definition	12V	PFL	+5V	+3.3V	-12V	-5V	HV+	PHV1	PHV4	PHV2	PHV3	HV-

Appendix C Initial Data of the Hard Disk

Disk Symbol	Directory	Directory & Filename	Description
C:	POD	3C5.pod	Transducer data
		7L4.pod	
			
	System	C6Prn_font_Cn.ttf	DC-6 Chinese print font
		C6Prn_font_Eu.ttf	DC-6 Europe print font
		C6Prn_font_Ru.ttf	DC-6 Russian print font
		C6Comm_font.ttf	DC-6 Comment font upgrade files
		C6Comm_font_FG.ttf	DC-6 French comment font upgrade files
		C6Comm_font_Ru.ttf	DC-6 Russian comment font upgrade files
		C6Bodymark.bin	Body mark data
		ColorSpectrum	Color spectrum
	Preset	MaintData.DTA	Maintenance data
		Current directory: Dicom_Preset.DTA PresetData.DTA	Current preset data (generated automatically, no need to copy)
		Factory directory: FactoryData.DTA	Factory settings (Preset directory shall be copied, while others are automatically generated)
	SelfTest	2105Test_B.FP1	Self-test data
		2105Test_C.FP1	Self-test data
		2105Test.FP2	Self-test data
		2105TEST.Dsp	Self-test data
	Picture	Demo	Demonstration of pictures and Cin files
		Video Test	Video test
		Dormancy	Screen protection picture
		Logo	Logo
		KeyBoardMap.bmp	Dialog box picture of user-defined keys
D:	Log	PowerONOff	Power ON/OFF log
		Operation	Operation log
		SelfTest	Self-test log

Appendix D Electrical Safety Inspection

The following electrical safety tests are recommended as part of a comprehensive preventive maintenance program. They are a proven means of detecting abnormalities that, if undetected, could prove dangerous to either the patient or the operator. Additional tests may be required according to local regulations.

All tests can be performed using commercially available safety analyzer test equipment. These procedures assume the use of a 601PRO_{XL} International Safety Analyzer or equivalent safety analyzer. Other popular testers complying with IEC 60601-1 used in Europe such as Fluke, Metron, or Gerb may require modifications to the procedure. Follow the instructions of the analyzer manufacturer.

The consistent use of a safety analyzer as a routine step in closing a repair or upgrade is emphasized as a mandatory step if an approved agency status is to be maintained. The safety analyzer also proves to be an excellent troubleshooting tool to detect abnormalities of line voltage and grounding, as well as total current loads.

ELECTRICAL SAFETY INSPECTION

1- Power Cord Plug

TEST PROCEDURE

◆ The Power Plug

The Power Plug Pins	No broken or bent pin. No discolored pins.
The Plug Body	No physical damage to the plug body.
The Strain Relief	No physical damage to the strain relief. No plug warmth for device in use.
The Power Plug	No loose connections.

◆ The Power Cord

The Power Cord	No physical damage to the cord. No deterioration to the cord. --For devices with detachable power cords, inspect the connection at the device. --For devices with non-detachable power cords, inspect the strain relief at the device.
----------------	---

ELECTRICAL SAFETY INSPECTION

2- Device Enclosure And Accessories

TEST PROCEDURE

◆ Visual Inspection

The Enclosure and Accessories

No physical damage to the enclosure and accessories.

No physical damage to meters, switches, connectors, etc.

No residue of fluid spillage (e.g., water, coffee, chemicals, etc.).

No loose or missing parts (e.g., knobs, dials, terminals, etc.).

◆ Contextual Inspection

The Enclosure and Accessories

No unusual noises (e.g., a rattle inside the case).

No unusual smells (e.g., burning or smoky smells, particularly from ventilation holes).

No taped notes that may suggest device deficiencies or operator concerns.

ELECTRICAL SAFETY INSPECTION

3- Device Labeling

TEST PROCEDURE

Check the labels provided by the manufacturer or the healthcare facilities are present and legible.

- *Main Unit Label*
- *Integrated Warning Labels*
- *Slope and High Voltage Caution Label*
- *Don't Stress Label*

ELECTRICAL SAFETY INSPECTION

4- Protective Earth Resistance

VOERVIEW

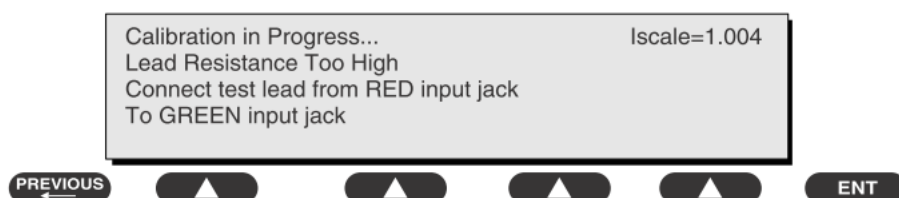
Protective Earth Resistance is measured using the RED test lead attached to the DUT Protective Earth terminal or Protective Earth Metal enclosure or equipotential terminal. Select the test current by pressing SOFT KEY 3 to toggle between 1AMP, 10AMP, and 25AMP. The front panel outlet power is turned off for this test.

The following conditions apply: L1 and L2 Open.

TEST PROCEDURE

◆ Prepare

- 1) First select the test current that will be used for performing the Protective Earth Resistance test by pressing AMPERES (SOFT KEY 3).
- 2) Connect the test lead(s) between the RED input jack and the GREEN input jack.
- 3) Press CAL LEADS. The 601PRO will measure the lead resistance, and if less than 0.150 Ohms, it will store the reading and subtract it from all earth resistance readings taken at the calibrated current.



- 4) If the calibration fails, the previously stored readings will be used until a passing calibration has occurred.

◆ Warning

During Earth Resistance testing, the DUT must be plugged into the 601PRO front outlet. If the DUT fails Earth Resistance, discontinue tests and label the device defective.

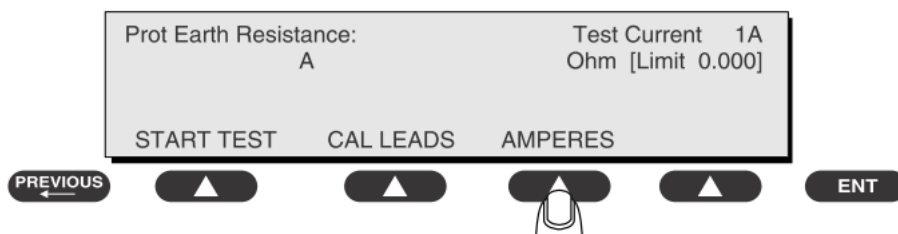
◆ Perform the Test

- 1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet.
- 2) Attach the 601PRO RED input lead to the device's Protective Earth terminal or an exposed metal area.

ELECTRICAL SAFETY INSPECTION

4- Protective Earth Resistance

- 3) Press shortcut key 3. The Protective Earth Resistance test is displayed.
- 4) Press SOFT KEY 3 to select a test current (1AMP, 10AMP, or 25AMP). The selected test current is displayed in the upper right corner of the display.



- 5) Press START TEST to start the test. The test current is applied while resistance and current readings are taken. This takes approximately 5 seconds.
- 6) Press the print data key at any time to generate a printout of the latest measurement(s).

◆ Note

When "Over" is displayed for Ohms, this signifies that a valid measurement was not obtained because either an open connection was detected or that the measurement was not within range. Readings greater than 9.999 Ohms will be displayed as Over.

◆ Failure

Once it reaches the limitation, stop using and inform the Customer Service Engineer for analysis and disposal.

LIMITS

ALL COUNTRIES R = 0.2Ω Maximum

ELECTRICAL SAFETY INSPECTION

5- Earth Leakage Test

OVERVIEW

Run an Earth Leakage test on the device being tested before performing any other leakage tests.

Leakage current is measured the following ways:

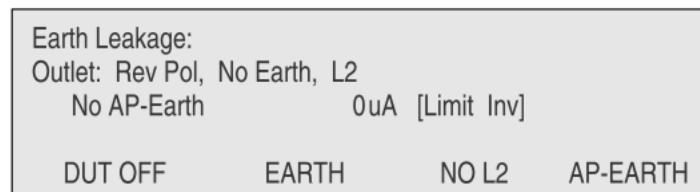
- ◆ Earth Leakage Current, leakage current measured through DUT outlet Earth
- ◆ Earth Leakage Current AP-EARTH (ALL Applied Parts connected to Earth), leakage current measured through DUT outlet Earth

There is no need to attach a test lead; the 601PRO automatically connects the measuring device internally.

TEST PROCEDURE

◆ Perform the Test

- 1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet, and turn on the device.
- 2) Attach the device's applied parts to the 601PRO applied part terminals if applicable.
- 3) Press shortcut key 4. The Earth Leakage test appears on the display, and the test begins immediately:



- PREVIOUS ▲ ▲ ▲ ENT
- SOFT KEY 1 toggles the DUT outlet Polarity from Normal to Off to Reverse.
 - SOFT KEY 2 toggles the DUT outlet from Earth to No Earth.
 - SOFT KEY 3 toggles the DUT outlet from L2 to No L2.
 - SOFT KEY 4 toggles the AP to Earth to No AP to Earth.
- 4) Press the print data key at any time to generate a printout of the latest measurement.

ELECTRICAL SAFETY INSPECTION

5- Earth Leakage Test

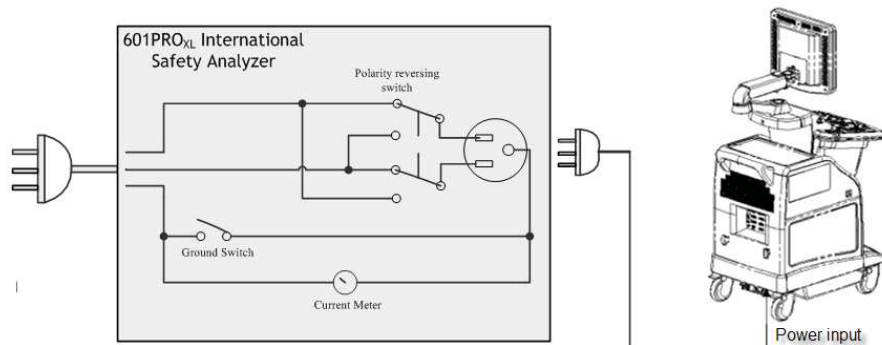


Figure 1 Earth leakage test

◆ Failure

Check any broken of the AC/DC adapter and its cable. Replace a new one if any portion defective.

Check any broken of the enclosure. Replace any defective part.

Inspect wiring for bad crimps, poor connections, or damage.

Test the wall outlet; verify it is grounded and is free of other wiring abnormalities. Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.

Change another probe to confirm if the fail is caused by console.

Inspect wiring for bad crimps, poor connections, or damage.

If the leakage current measurement tests fail on a new unit and if situation can not be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.

If all else fails, stop using and inform the Customer Service Engineer for analysis and disposal.

LIMITS

UL60601-1: 300 μ A Normal Condition
1000 μ A Single Fault Condition

IEC60601-1: 500 μ A Normal Condition
1000 μ A Single Fault Condition

ELECTRICAL SAFETY INSPECTION

6- Patient Leakage Current

OVERVIEW

Patient leakage currents are measured between a selected applied part and mains earth. All measurements may have either a true RMS.

TEST PROCEDURE

◆ Prepare

Perform a calibration from the Mains on Applied Part menu.

The following outlet conditions apply when performing this test:

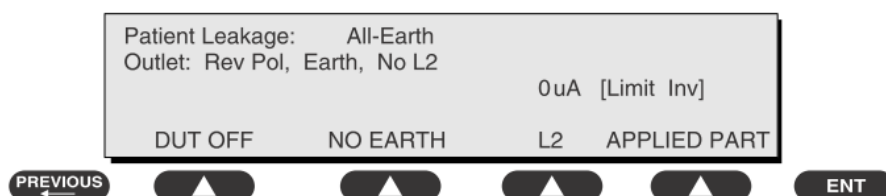
Normal Polarity, Earth Open, Outlet ON	Normal Polarity, Outlet ON
Normal Polarity, L2 Open, Outlet ON	Reversed Polarity, Outlet ON
Reversed Polarity, Earth Open, Outlet ON	Reversed Polarity, L2 Open, Outlet ON

◆ Warning

If all of the applied parts correspond to the instrument type, the applied parts will be tied together and one reading will be taken. If any of the applied parts differ from the instrument type, all applied parts will be tested individually, based on the type of applied part. This applies to Auto and Step modes only.

◆ Perform the Test

- 1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet, and turn on the device.
- 2) Attach the applied parts to the 601PRO's applied part terminals.
- 3) Press shortcut key 6. The Patient Leakage test is displayed, and the test begins immediately.



- 4) Press APPLIED PART (SOFT KEY 4) at any time to select the desired applied part leakage current.
- 5) Modify the configuration of the front panel outlet by pressing the appropriate SOFT

ELECTRICAL SAFETY INSPECTION

6- Patient Leakage Current

KEY on the 601PRO.

- 6) Press the print data key at any time to generate a printout of the latest measurement.

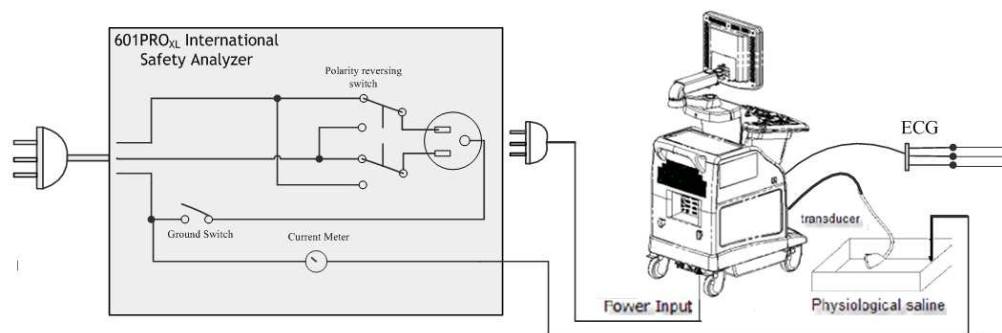


Figure 2 patient leakage Current

◆ Note

If the current test standard being used does not include Patient Leakage DC readings, or the DC option is not enabled, then DC readings will not be available through the APPLIED PART SOFT KEY selections. Refer to Chapter 8, Standards and Principles.

◆ Failure

Check any broken of the AC/DC adapter and its cable. Replace a new one if any portion defective.

Check any broken of the enclosure. Replace any defective part.

Inspect wiring for bad crimps, poor connections, or damage.

Test the wall outlet; verify it is grounded and is free of other wiring abnormalities. Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.

Change another probe to confirm if the fail is caused by console.

Inspect wiring for bad crimps, poor connections, or damage.

If the leakage current measurement tests fail on a new unit and if situation can not be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.

If all else fails, stop using and inform the Customer Service Engineer for analysis and disposal.

LIMITS

For BF: ECG Input and transducer

100 μ A Normal Condition

500 μ A Single Fault Condition

ELECTRICAL SAFETY INSPECTION

7- Mains on Applied Part Leakage

OVERVIEW

The Mains on Applied Part test applies a test voltage, which is 110% of the mains voltage, through a limiting resistance, to selected applied part terminals. Current measurements are then taken between the selected applied part and earth. Measurements are taken with the test voltage (110% of mains) to applied parts in the normal and reverse polarity conditions as indicated on the display.

The following outlet conditions apply when performing the Mains on Applied Part test.

Normal Polarity;

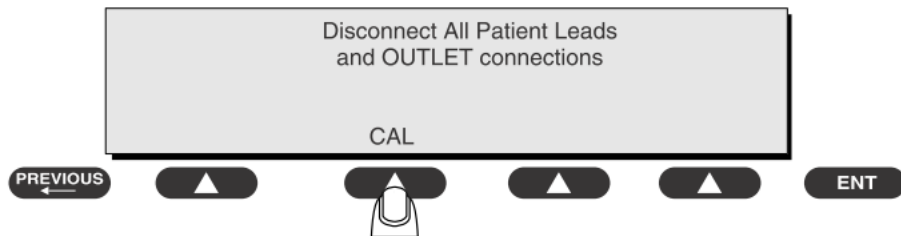
Reversed Polarity

TEST PROCEDURE

◆ Prepare

To perform a calibration from the Mains on Applied Part test, press CAL (SOFT KEY 2).

- 1) Disconnect ALL patient leads, test leads, and DUT outlet connections.
- 2) Press CAL to begin calibration, as shown:



If the calibration fails, the previously stored readings will be used until a passing calibration has occurred. Also, the esc/stop key has no effect during calibration.

- 3) When the calibration is finished, the Mains on Applied Part test will reappear.

◆ Warning

- 1) A 2-beep-per-second signal indicates high voltage present at the applied part terminals while a calibration is being performed.
- 2) High voltage is present at applied part terminals while measurements are being taken.

◆ Performance

- 1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601
- 2) Attach the applied parts to the 601PRO applied part terminals.
- 3) Attach the red terminal lead to a conductive part on the DUT enclosure.
- 4) Press shortcut key 7. The Mains on Applied Part test is displayed.

ELECTRICAL SAFETY INSPECTION

7- Mains on Applied Part Leakage

- Mains on Applied Part: All-Earth
Outlet: Norm Pol, Earth, L2
Norm uA Rev uA [Limit Inv]

START TEST CAL DUT OFF APPLIED PART
- PREVIOUS ▲ ▲ ▲ ▲ ENT
- 5) Select the desired outlet configuration and applied part to test using the appropriate SOFT KEYS:
 - 6) Press START TEST (SOFT KEY 1) to begin the test.
 - 7) Press the print data key to generate a printout of the latest measurement.

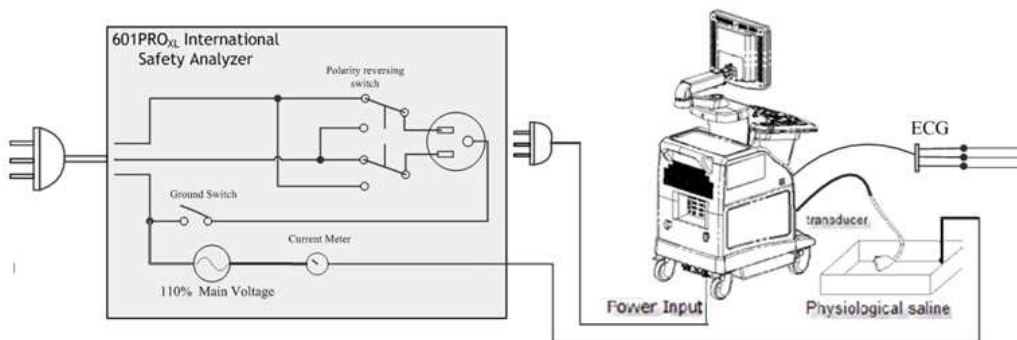


Figure 3 Mains on Applied part leakage

◆ Note

If all of the applied parts correspond to the instrument type, the applied parts will be tied together and one reading will be taken. If any of the applied parts differ from the instrument type, all applied parts will be tested individually, based on the type of applied part. This applies to Auto and Step modes only.

◆ Failure

Check any broken of the AC/DC adapter and its cable. Replace a new one if any portion defective.

Check any broken of the enclosure. Replace any defective part.

Inspect wiring for bad crimps, poor connections, or damage.

Test the wall outlet; verify it is grounded and is free of other wiring abnormalities. Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.

Change another probe to confirm if the fail is caused by console.

Inspect wiring for bad crimps, poor connections, or damage.

If the leakage current measurement tests fail on a new unit and if situation can not be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.

If all else fails, stop using and inform the Customer Service Engineer for analysis and disposal.

ELECTRICAL SAFETY INSPECTION

7- Mains on Applied Part Leakage

LIMITS

For BF:ECG Input and transducer

5000 μ A

ELECTRICAL SAFETY INSPECTION

8- Patient Auxiliary Current

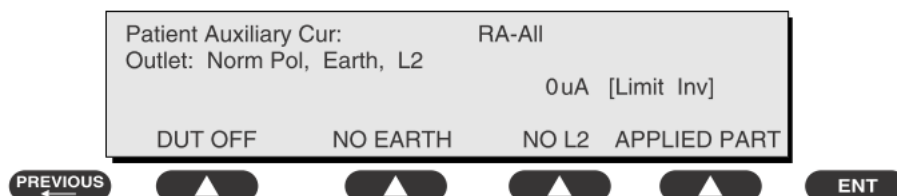
overview

Patient Auxiliary currents are measured between any selected ECG jack and the remaining selected ECG jacks. All measurements may have either a true RMS or a DC-only response.

TEST PROCEDURE

◆ Prepare

- 1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet, and turn on the device.
- 2) Attach the patient leads to the 601PRO ECG jacks.
- 3) Define the Lead Types from the View Settings Option (refer to: Lead Type Definitions in Section 5 of this chapter).
- 4) Press shortcut key 8. The Patient Auxiliary Current test is displayed, and the test begins immediately. Display values are continuously updated until another test is selected.



- 5) Press SOFT KEYS 1-4 to select leakage tests
- 6) Press APPLIED PART (SOFT KEY 4) at any time to select the desired applied part leakage current:
- 7) Modify the configuration of the front panel outlet by pressing the appropriate SOFT KEY on the 601PRO:
- 8) Press the print data key at any time to generate a printout of the latest measurement.

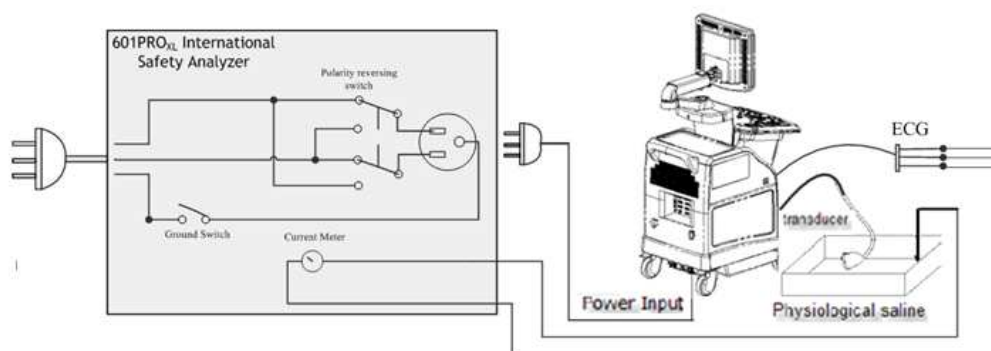


Figure 4 patient Auxiliary Current

◆ Note

ELECTRICAL SAFETY INSPECTION

8- Patient Auxiliary Current

If the current test standard being used does not include Patient Auxiliary Current DC readings, or the DC option is not enabled, then DC readings will not be available through the APPLIED PART SOFT KEY selections.

◆ Failure

Check any broken of the AC/DC adapter and its cable. Replace a new one if any portion defective.

Check any broken of the enclosure. Replace any defective part.

Inspect wiring for bad crimps, poor connections, or damage.

Test the wall outlet; verify it is grounded and is free of other wiring abnormalities. Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.

Change another probe to confirm if the fail is caused by console.

Inspect wiring for bad crimps, poor connections, or damage.

If the leakage current measurement tests fail on a new unit and if situation can not be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.

If all else fails, stop using and inform the Customer Service Engineer for analysis and disposal.

LIMITS

For BF: ECG Input

100 μ A Normal Condition

500 μ A Single Fault Condition

ELECTRICAL SAFETY INSPECTION FORM

(Class I equipment)

Overall assessment:

Scheduled inspection	Test item: 1, 2, 3, 4, 5, 6, 7, 8
Unopened repair type	Test item: 1, 2, 3
Opened repair type, not modify the power part including transformer or patient circuit board	Test item: 1, 2, 3, 4
Opened repair type, modify the power part including transformer	Test item: 1, 2, 3, 4, 5
Opened repair type, modify patient circuit board	Test item: 1, 2, 3, 4, 6, 7, 8

Location:				Technician:	
Equipment:				Control Number:	
Manufacturer:		Model:		SN:	
Measurement equipment /SN:				Date of Calibration:	
INSPECTION AND TESTING				Pass/Fail	Limit
1	Power Cord Plug				
2	Device Enclosure and Accessories				
3	Device Labeling				
4	Protective Earth Resistance		Ω		Max 0.2 Ω
5	Earth Leakage	Normal condition(NC)	____ μ A		Max: NC: 300 μ A(refer to UL60601-1) * NC: 500 μ A(refer to IEC60601-1) * SFC: 1000 μ A
		Single Fault condition(SFC)	____ μ A		
6	Patient Leakage Current	Normal condition(NC)	☐ BF____ μ A		Max: BF applied part: NC:100 μ A, SFC: 500 μ A
		Single Fault condition(SFC)	☐ BF____ μ A		
7	Mains on Applied Part Leakage		☐ BF____ μ A		Max: BF applied part: 5000 μ A
8	Patient Auxiliary Current	Normal condition(NC)	☐ BF____ μ A		Max: BF applied part: NC:100 μ A, SFC: 500 μ A
		Single Fault condition(SFC)	☐ BF____ μ A		
9	Functional test (parameters tested):				

Note:

The equipment which sell to America shall comply with the requirement of UL60601-1, others shall comply with the requirement of IEC60601-1.

Name/ Signature: _____ Date: _____

